DECEMBER 14, 1953

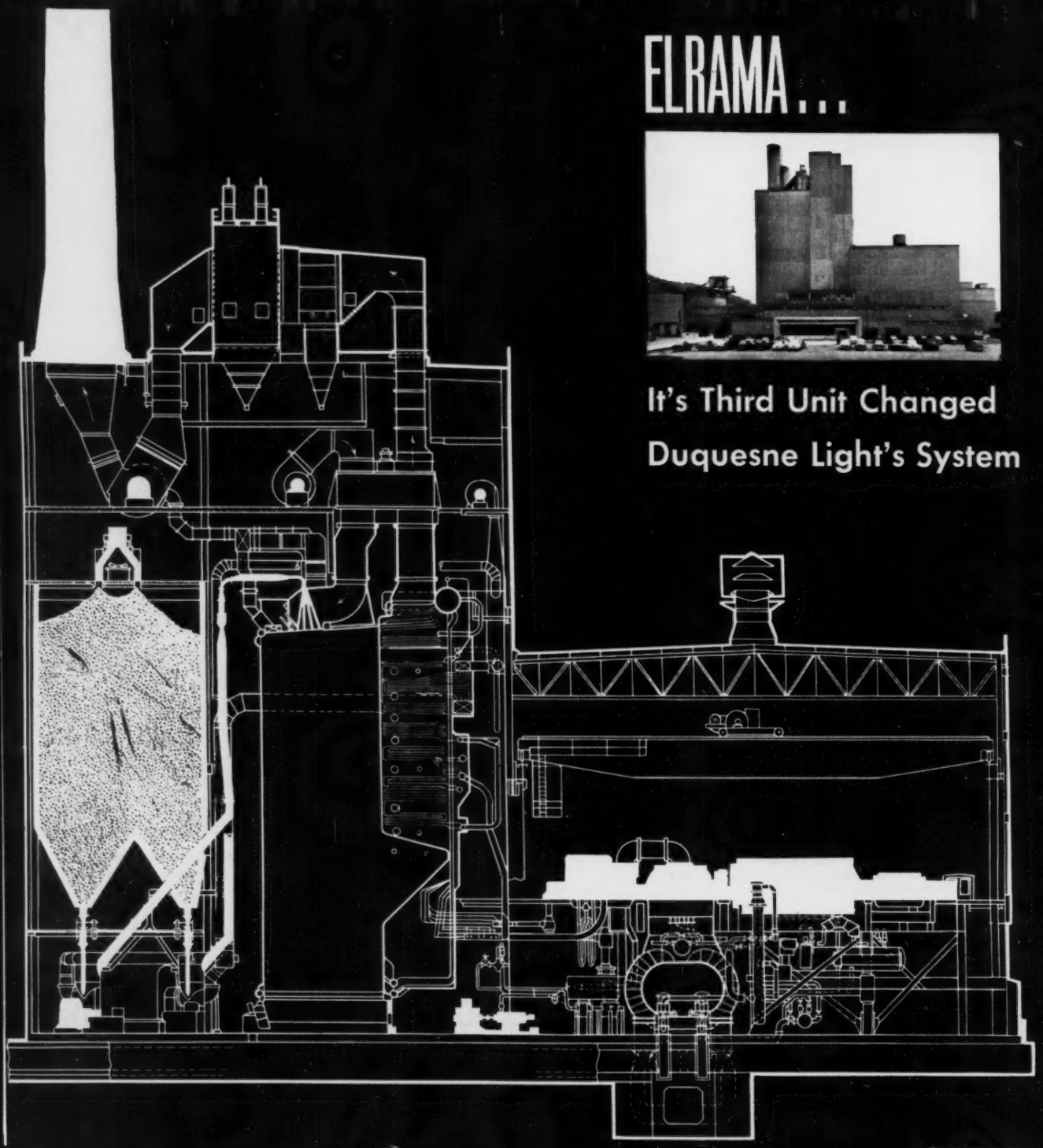
Electrical World

Price 35 Cents

A McGRAW-HILL PUBLICATION

ELRAMA...

It's Third Unit Changed Duquesne Light's System

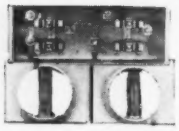


Murray

Quality Equipment — serving the electrical industry for over half a century.

METERING EQUIPMENT

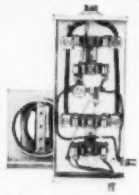
ROUND METER SOCKETS
10 types available.



SOCKET METER TROUGHS
Indoor gangable.

SOCKET METER TROUGHS WITH AND WITHOUT HUBS

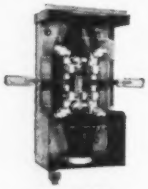
Raintight type — horizontal.



Raintight type — vertical.

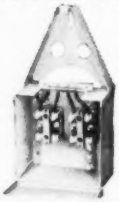
SOCKET METER MOUNTINGS — RAINTIGHT TYPE

Medium duty, single phase and polyphase.

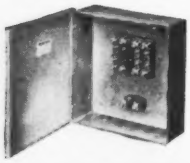


Heavy duty.
Up to 200 Amperes.

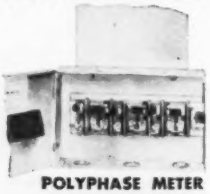
SOCKET METER ADAPTER
For "A" Base Meter Boxes.
Indoor and Outdoor.



"A" BASE METER CONNECTION BOX
Raintight type.
Two sizes up to 2/0 wire.



"A" BASE METER MOUNTING AND TEST CABINET
Indoor. Single phase and polyphase up to 200 Amps.

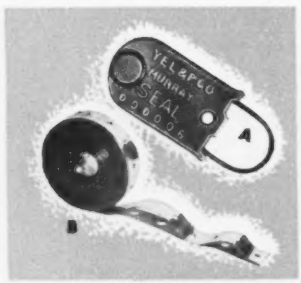


POLYPHASE METER MOUNTING AND TEST CABINET
C.T. current transformer cabinets available.

The *Crowsnest*
AERIAL LADDERS

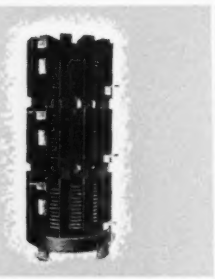
New pedestal mount occupies least truck floor space. Fastest, easiest and safest operation. Made in three working heights — 29', 32'9 and 36'8.

COMBINATION METER SOCKET AND CIRCUIT BREAKER
Service Equipment.
One piece construction.



A. Tamper-proof Meter Seals, custom embossed.
B. Non-corrosive zinc strapping.

CABLE RACKS AND STANCHIONS
Light and heavy duty.
Porcelain insulators.



CURRENT LIMITING REACTORS
Dry type. Glass insulation.

Murray®

ADEQUATE WIRING SERVES AND SAVES — THE KEY TO THE MODERN HOME

For complete information, write Dept. U2.

MURRAY MANUFACTURING CORPORATION
1250 ATLANTIC AVENUE, BROOKLYN 16, N. Y.

Service Entrance and Meter Equipment • Magnetic Hydraulic Circuit Breakers • Safety Switches (Types A, C & D)
Current Limiting Reactors • Crows'nest Aerial Ladders • Utility Specialties

MEET THIS WEEK'S WRITERS

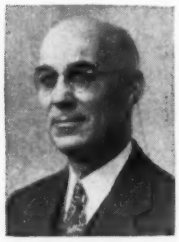
A. J. Pansini, who discusses Long Island Lighting Co's new electric operating headquarters at Hicksville, (page 134), visited 12 power companies in the country during 1950 gathering ideas for the new center.

A. J. PANSINI

In the utility business for 27 years, he started with United Electric Light & Power Co, subsequently absorbed by Consolidated Edison Co of N. Y. Since joining Long Island Lighting in 1941, he has worked on overhead and underground transmission and distribution systems.

A holder of B.S. and E.E. degrees from Cooper Union in New York, he is 44, married, and has a daughter, aged 6. He uses part of his Roslyn Heights, L. I. home for a workshop and, in quieter moments, reads American history and collects coins.

J. STANLEY BROWN, who on page 123 describes the innovations in Duquesne Light Co's Elrama power station, has served the utility since 1937 and in October was named its chief engineer. He had been electrical station engineer and, most recently, headed up the Pittsburgh utility's Electrical Engineering Department.



J. S. BROWN

A native of Menominee, Mich., he had previously been associated with General Electric Co, Radio Corp of America, Stone & Webster Engineering, and Potomac Electric Power.

Long interested in radio engineering, one of his favorite diversions is the ham radio station he has operated since 1914. He is also an amateur machinist and industrial model maker. He lives in Mt. Lebanon, Pa., and has a daughter and two grandchildren in Wheeling, W. Va.

Electrical World

Published for 79 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Vol. 140 No. 24 CONTENTS December 14, 1953

Features

Determining Potential Rise in Station Ground Mats....Martin J Lantz 127

Elrama Demands System Changes.....J Stanley Brown 123

L. I. Lighting Builds to Expand.....A J Pansini 134

New Firing Method Cuts Power Cost.....S T MacKenzie 130

Intertie Helps Atlantic City Electric Delay New Plant.....W F Caven 138

Departments

Editorials 113
The Electrical Week 115
Washington Comment 141
Technical Notes 141
Statistics 142
Financial News 143
How To 149
Engineering Reference Sheet 152
Sales and Service 170
Industrial Applications 180
New Equipment 198
Letters 213
What They're Saying 214
News About People 216
Manufacturers & Markets 222
Meetings 256
Index of Advertisers 232

RALPH H FLYNN, Publisher FISCHER BLACK, Editor DANIEL T. BRAYMER, Managing Editor

A E KNOWLTON ..... Senior Associate Editor
FRANK R INNES ..... Associate Editor
LEONARD M OLMSTED ..... Associate Editor
ROBERT C BLATT ..... Associate Editor
KENNETH K KOST ..... Associate Editor
HERBERT FRANKEL ..... Associate Editor
EDWARD ALLEN ..... Midwestern Editor
HOWARD S KNOWLTON ..... New England Editor
RUE M SHOOP ..... Middle Eastern Editor
FRANCIS KOVALCIK ..... Western Editor
JOSEPH MICHALAK ..... Assistant Editor

DAVID REA ..... Assistant Editor
JOHN F WICKLEIN ..... News Editor
JEANNE BERNHARDT ..... Assistant News Editor
IRIS ST CLAIR ..... Departmental Editor
ARY MOSSIMAN ..... Manager of Market Research
ANN L ADAMS ..... Production Editor
W J WALLACE, JR ..... Assistant Art Director
G B BRYANT ..... Mgr Washington Bureau
JESSE MOCK ..... Washington Correspondent
DEXTER M KEEZER ..... Dir Economics Department

ROBERT P ULIN, RICHARD W EVERETT—Economics Department

WORLD NEWS BUREAU: Joseph K Van Denburg, Jr., Editor; London, Paris, Frankfurt, Tokyo, Sao Paulo, Mexico City, Manila. DOMESTIC NEWS SERVICE: Atlanta, Chicago, Cleveland, Detroit, San Francisco. Correspondents in 43 cities.

ADVERTISING STAFF: District Managers, E F Coffey, New York; N V Palmer, Boston; F P Coyle, Philadelphia; M S Kearney, Cleveland; E S Chapin, Detroit; W. H. Meneilley, Chicago; J T Schaefer, St. Louis; Robert H Sidur, Atlanta; Carl W Dysinger, Los Angeles; John W Otterson, San Francisco; James Cash, Dallas

December 14, 1953 ABP ELECTRICAL WORLD ABC Vol. 140, No. 24

Published weekly by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. Publication Office, 99-129 North Broadway, Albany 1, N. Y. Executive, Editorial and Advertising Office: McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y. Donald C. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.

Subscriptions; Address correspondence to Electrical World—Subscription Service, 99-129 N. Broadway, Albany 1, N. Y., or 330 W. 42nd St., New York 36, N. Y. Allow one month for change of address.

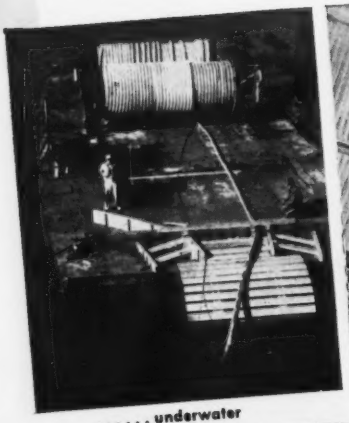
Subscriptions are accepted from executive, supervisory and engineering personnel in electric utilities, manufacturing companies, and related fields. Positions and company connection must be indicated on subscription orders.

Single copies 35¢. For the United States and Possessions $6 a year, $9 for two years, $12 for three years. Canada, $7 for one year, $11 for two years, $14 for three years. (Canadian money, at par.) Other Western Hemisphere, $15 for one year, $25 for two years, $30 for three years. All other countries $25 for one year, $40 for two years, $50 for three years. Entered as second-class matter, November 16, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in USA.
Copyright 1953, by McGraw-Hill Publishing Company, Inc. Permission required to reproduce any of contents.

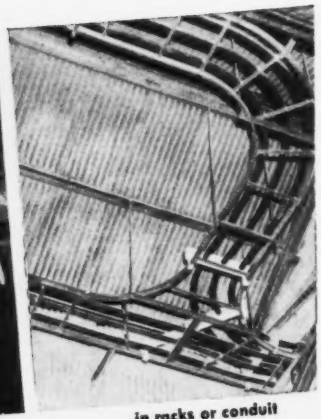
case history

use it anywhere

The versatility of Okolite rubber-insulated high voltage cables is demonstrated by these three typical installations. The first shows an installation of the Portland General Electric Company—two 1,800-ft. 13-kv rubber-insulated submarine cables being laid across the Willamette River. The next shows six 23-kv Okolite-Okoprene transformer leads at The Diamond Portland Cement Company. The bottom, four 390-ft. spans of three-conductor self-supporting Okolite-Okoprene cables at the Covington, Virginia plant of West Virginia Pulp and Paper Company.



. . . . . underwater



. . . . . in racks or conduit

. . . . . on messenger

WHY THEY'RE SWITCHING TO OKOLITE rubber-insulated cables for use up to 35,000 volts

There is a distinct trend among industrials and public utilities toward Okolite rubber-insulated cables for high voltage use.

ADVANTAGES

1. Lighter and easier handling.
2. Eliminates sheath corrosion and fatigue.
3. Simplifies splicing and terminating.
4. Moisture does not affect the insulation.
5. No oil migration at high temperatures or elevations.
6. Flexibility simplifies installation.

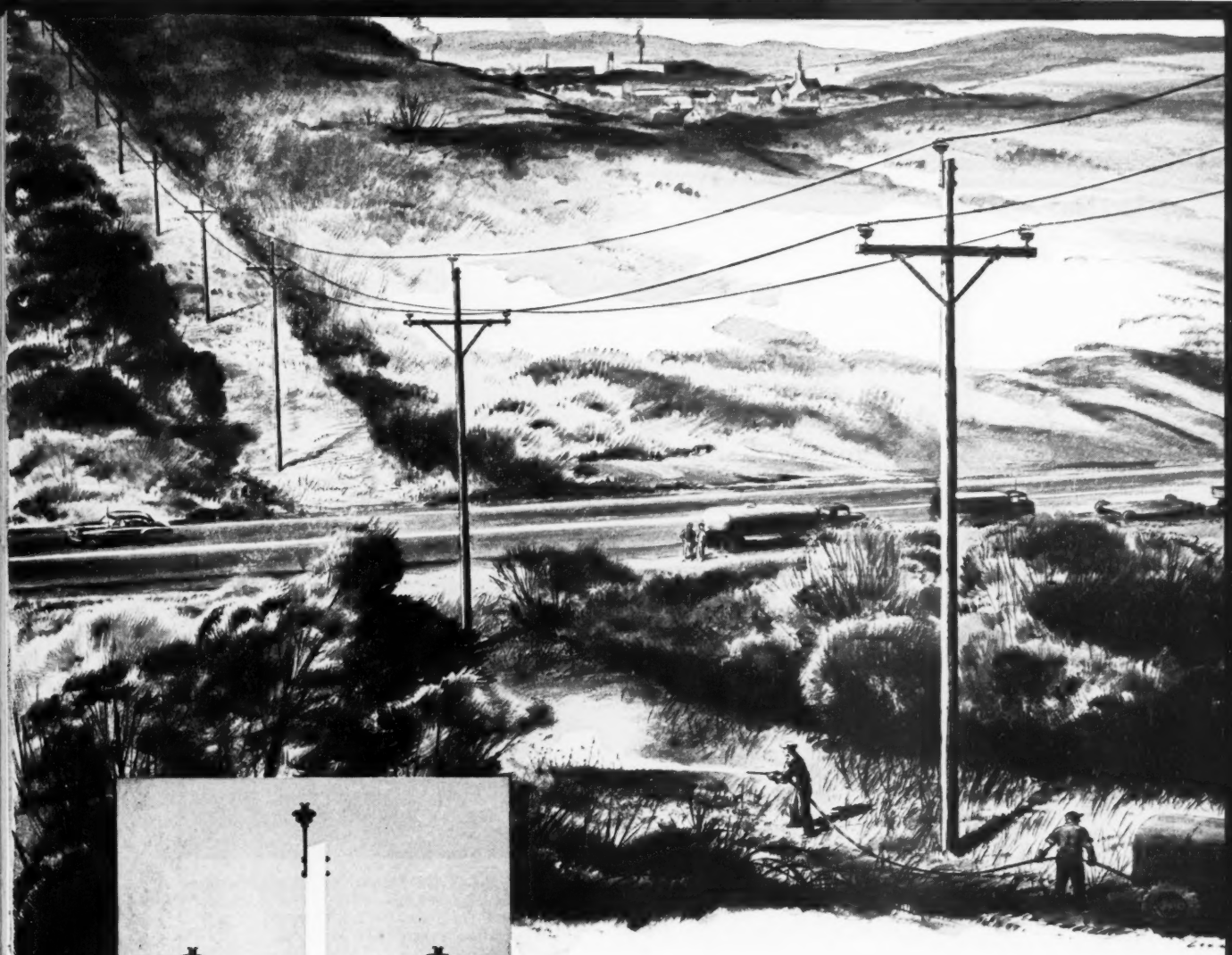
APPLICATIONS

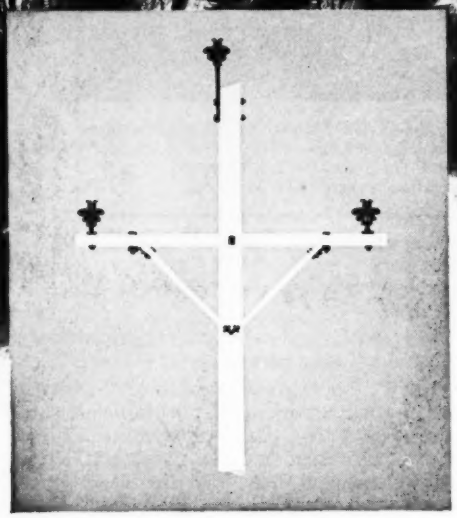
1. Transmission and distribution circuits.
2. Generator and transformer leads.
3. Vertical risers and shaft cables.
4. Submarine power cables.
5. Portable substation cables and test leads.
6. X-ray cables.

In the air, underground, underwater, in racks, ducts or conduits, Okolite-Okoprene rubber-insulated high voltage cables can be installed easily and permanently. The design and construction of this type of cable has been proved in all kinds of service for more than 25 years. The entire subject of rubber-insulated cable for high voltage application is covered in the new Okonite 128-page manual illustrated at right. Write for Bulletin EW-1075 on your letterhead to The Okonite Company, Passaic, New Jersey.

OKONITE SINCE 1878 *insulated cables*

1872





Type 401
Triangular structure*

Quantity	Description
1	Crossarm
1 pr	Wood crossarm brace
2	Washerhead bolt ½" w/sq. nut and flanged 3" x 3/16" washer
3	Pin type insulator
1	Curved shouldereye bolt ⅝" w/washer
2	Crossarm pin long shank
3	Machine bolt ⅝" w/locknut
2	Curved washer 2¼" sq.
1	Washer 2¼" sq. x 3/16", 13/16" hole
1	Spring washer ⅝"

**This print was reproduced from the Graybar Bulletin GB-5076A on High Voltage Transmission Line Materials. This 92-page book covers, in condensed form, Graybar materials for transmission line construction. Write us, if you do not already have your free copy.*

From Bolts to Brush Killer — it Pays to Order via Graybar

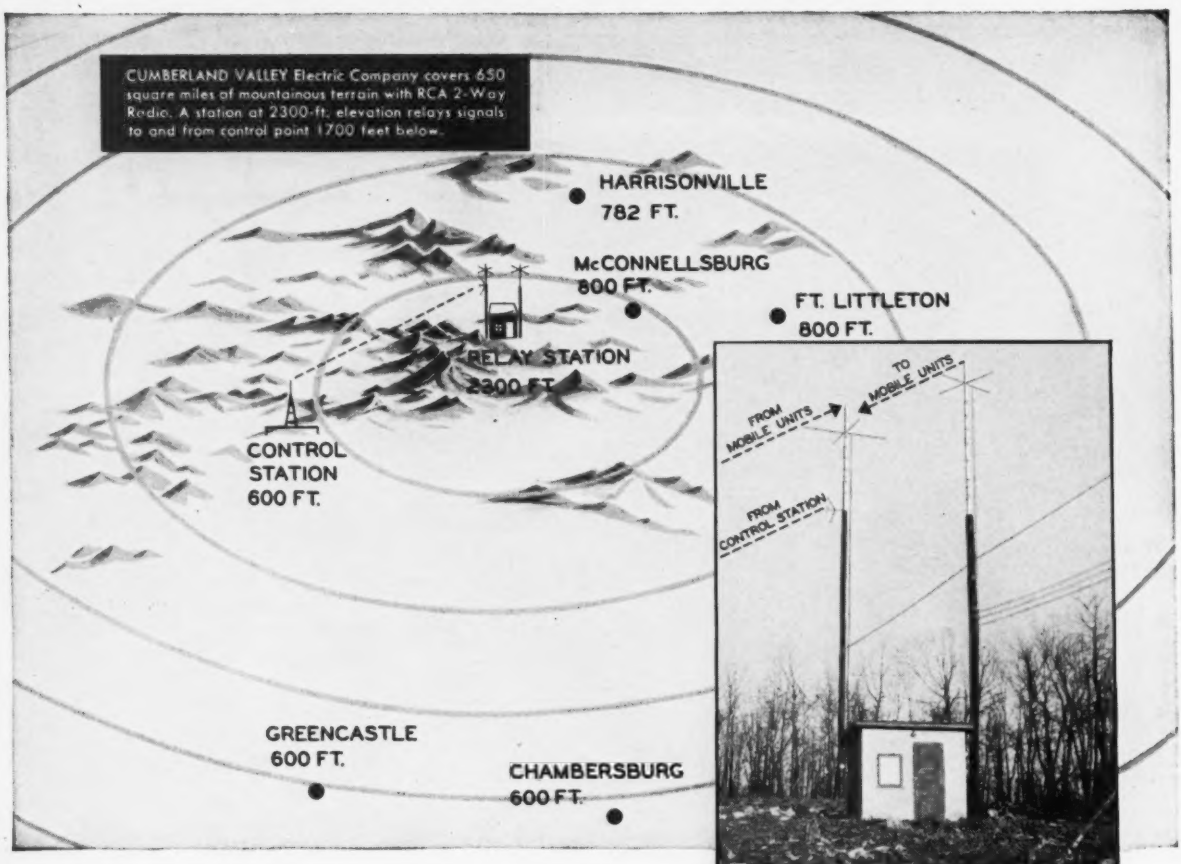
When you build transmission or distribution lines – whether a few hundred yards or a hundred miles – there's a simple way to fill *all* your material and supply requirements. Just order *via Graybar.*

Location makes little difference – there's always a Graybar office or warehouse as near as your telephone. You can get product and performance data on more than 100,000 different electrical items and the help of experienced Graybar Outside Construction Specialists in solving unusual problems.

When undergrowth interferes with your lines, Graybar can supply brush killers of proved effectiveness. When you need an on-the-job delivery of prefabricated, prebored, prefitted crossarms, count on Graybar for a package operation. In fact, on any line building project, you can add fully staffed offices and warehouses to your own organization by ordering *via* Graybar. *Graybar Electric Co., Inc. Executive Offices: Graybar Building, New York 17, N. Y.* 355-912

CALL GRAYBAR FIRST FOR... Graybar Everything Electrical

IN OVER 100 PRINCIPAL CITIES



HILLTOP RELAY STATION receives signals from control station on 73.98 mc. and from mobile units on 48.54 mc. Station transmits on 37.58 mc.

RCA 2-Way Radio raises Cumberland Valley 1700 feet

VHF radio relay has recently converted a difficult piece of terrain into ideal radio territory for Cumberland Valley Electric Company, of Mercersburg, Pennsylvania.

Working with RCA communications men, Cumberland Valley engineers virtually lifted the utility's headquarters from its valley site, and placed it on a hilltop seven miles away. From this vantage point the company achieves unusual efficiency, over its 650 square-mile service area.

In addition, the installation permits twenty-four-hour communication between mobile units without requiring a twenty-four-hour dispatcher. Superior car-to-car communication, provided by the hilltop relay, keeps crews in direct contact with each other during dispatcher's off-duty hours.

For engineering assistance on difficult communications problems, contact the RCA Communications Specialist at your local RCA Regional Office. For day-in, day-out dependability, specify RCA 2-Way Radio. For Literature... clip coupon below, and mail it today.

RCA®

RADIO CORPORATION of AMERICA
COMMUNICATIONS EQUIPMENT CAMDEN, N. J.

Radio Corporation of America
Communications Equipment, Dept. 15XB
Building 15-1, Camden, New Jersey

☐ Please send me information on RCA 2-Way Radio.

☐ Please have an RCA Communications Specialist call on me.

Name_____ Title_____

Company_____ Address_____

City_____ Zone____ State_____

Part of the welding floor at Grinnell's Warren, Ohio Plant

How shop fabrication of piping

keeps costs down...quality up!

When you specify piping fabricated in Grinnell shops, you are ALL to the good.

Here's why: — Included in the price (which is determined in advance) are such items of expense as:

- Interpretive engineering
- Shop sketches and planning
- Procurement of materials
- Heat, light, power, water, compressed air, expendable tools and supplies

But Grinnell even goes further. Grinnell finances material inventories and payrolls for you; carries insurance; makes no charges for waste material or spoilage.

On the production side, too, you benefit. Piping fabricated in Grinnell shops is done under ideal conditions, with modern equipment, by personnel qualified for each class of work. It is rigidly inspected and tested to meet customer's specifications and all applicable codes. Before shipment, it is cleaned inside and outside and painted. It is squared to dimensional tolerances, so that sub-assemblies can be erected at the job site quickly and easily.

You can count on it . . . Grinnell shop fabricated piping *guarantees* maximum quality and economy.

Heavy wall pipe being machined to the proper welding bevel on a post mill

Welding (induction heating coils in place for preheat, welding heat and stress relieving.)

GRINNELL

WHENEVER PIPING IS INVOLVED

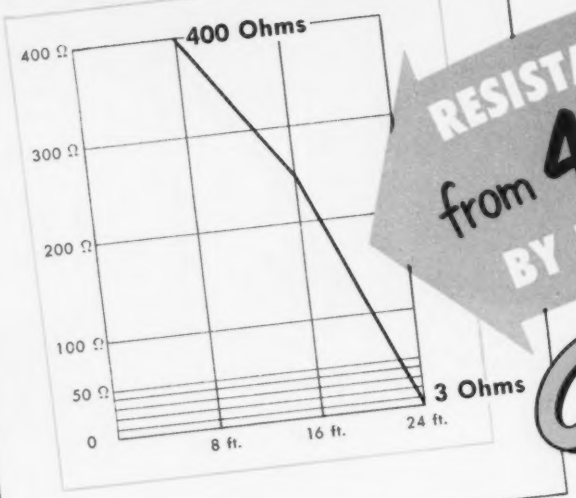
Grinnell Company, Inc., Providence, Rhode Island • **Coast-to-Coast Network of Branch Warehouses and Distributors**

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

DEEP GROUNDING

—the simple, low-cost method to get TOP PERFORMANCE AND SAFETY from your Protective Equipment

In Corpus Christi, Texas • • •



RESISTANCE LOWERED from 400 to 3 Ohms BY DEEP GROUNDING

with

Copperweld® SECTIONAL GROUND RODS

To insure better line performance, greater safety and maximum protection against costly outages, low resistance ground connections are a must. It's a fact that in most localities, good conducting soils are found only at a considerable depth below the surface. For example, in Corpus Christi, Texas, an 8-ft. ground rod showed a resistance of 400 ohms, which, of course, can hardly be called a ground. But, when additional sections of Copperweld* Ground Rods were added to reach a depth of 24 feet, the resistance dropped to 3 ohms. Quite a difference!

Time after time, deep grounding with Copperweld Sectional Ground Rods has proved to be the most economical way to reach the strata of low resistance. With Copperweld Sectional Ground Rods, you get permanent protection that multiplies the effectiveness of your lightning arresters, over-voltage protectors and overhead ground wires.

Copperweld Sectional Ground Rods have a stiff steel core to provide the rugged strength for easy driving. This core is permanently protected from corrosion by a thick, molten-welded layer of copper having high conductivity. No other ground rod has this inseparable molten-weld which eliminates the possibility of electrolytic action.

If you want to reduce outages and insure greater revenue through continuity of service, use Copperweld Sectional Ground Rods and drive them down to "pay dirt."

*Trade Mark

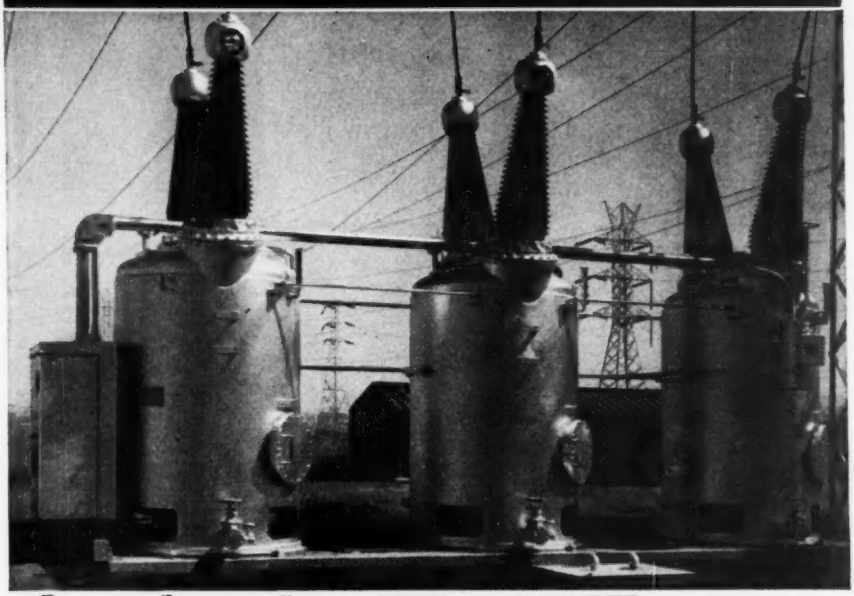
Any of these Copperweld Sectional Rods may be used as a top, intermediate, or bottom section. They are roll-threaded on both ends.

As each Copperweld Sectional Ground Rod is driven, the next rod is joined to it by means of a heavy bronze coupling, and the driving procedure is then repeated.

THEY'RE MOLTEN-WELDED Copperweld GROUND RODS

COPPERWELD STEEL COMPANY
Glassport, Pa.
SALES OFFICES IN PRINCIPAL CITIES

Oil-Hydraulic Energy Transfer and Control of End-of-Stroke Conditions

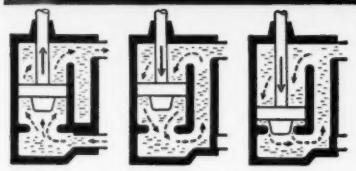


PACIFIC ELECTRIC Type RHE CIRCUIT BREAKERS

115 to 230 kv
3 cycle
to 10,000,000
interrupting kva
(at 161 or 230 kv)

Ground-mounted (as illustrated) or common-base mounted (115, 138, and 161 kv)

At left:
Type RHE 196/230 kv
3-cycle, 7,500,000 int. kva
10-cycle closing
20-cycle reclosing
(minimum 15 cycles if ordered)

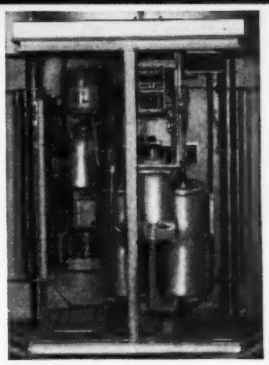


Multi-Use of Oil-Hydraulic Cylinder

UP STROKE Energy transfer to closing springs

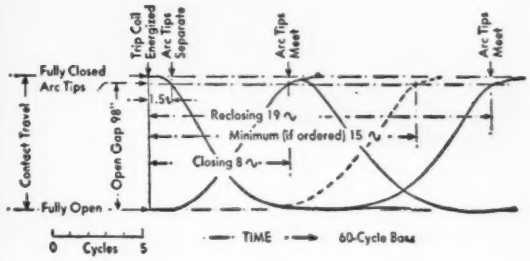
During DOWN STROKE Energy transfer to opening springs

Toward end of DOWN STROKE Orifice restriction absorbs shock



At right:
Operating Mechanism with Doors Open

Below: Contact-travel time chart showing open-close and close-open operations with oil in tanks



FAST Opening . . . Important? . . . Yes!

But equally important is stopping the mechanism so it comes to rest without undue shock or rebound. Also the breaker should *open fully* before reclosing to prevent impairment of insulation during the critical surge time that follows interruption caused by repetitive lightning.

How well Pacific Type RHE breakers perform in these respects is shown in the time-travel diagram at right.

Oil-hydraulic control of these end-of-stroke conditions is the reason why. The same oil-hydraulic cylinder and piston serves the dual purpose of (1) transferring closing energy to the closing springs on the up-stroke, and (2) decelerating the contact mechanism toward the end of the down stroke (see schematic diagrams at left).

OTHER FEATURES:

- Opening and closing springs and shock absorbers are outside of the tanks
- Nested Sliding Shoe (finger) Contacts
- Improved Interrupters
- Easy manual emergency operation for load switching as well as for test.

Since 1906

SALES OFFICES or AGENCIES in PRINCIPAL CITIES

PACIFIC ELECTRIC • MFG. CORPORATION •

SUBSIDIARY OF FEDERAL ELECTRIC PRODUCTS COMPANY

5815 THIRD STREET, SAN FRANCISCO 24, CALIFORNIA

OTHER FACTORIES: SANTA CLARA, CALIF.; SCRANTON, PENNA.

PERFORMANCE HERE DEPENDS ON THIS

Courtesy Bucyrus - Erie Co.

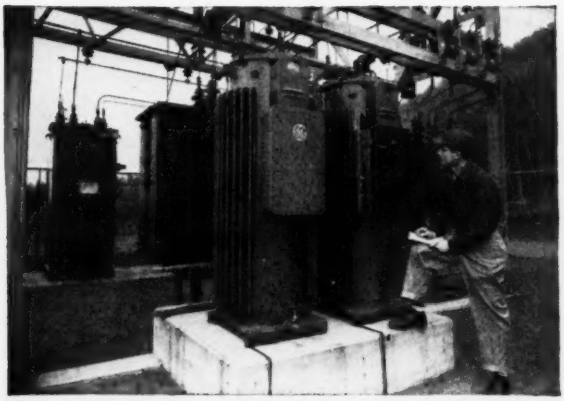
A measure of a shovel's efficiency is the size of its bite. But of equal importance is the length of time the shovel will keep on biting. That is why the trailing cable that transmits power to the shovel should be as good as you can buy. Compared with the cost of the shovel or other material-handling equipment, the cost of the trailing cable is insignificant. Yet a breakdown in this cable can have a disastrous effect on your cost. Nothing but the best is good enough.

TIREX Cables are first-quality cables. They are engineered for tough, long-lasting service. Service records covering many years prove that they give the service expected of them.

Whether the service is on a slusher hoist, a cutting machine, a continuous miner, or a stripping shovel, there is a size and type of TIREX Cable to fit every job. Whenever you need a portable cord or cable specify and be sure that you get Simplex-TIREX Cords or Cables. There are none better made.

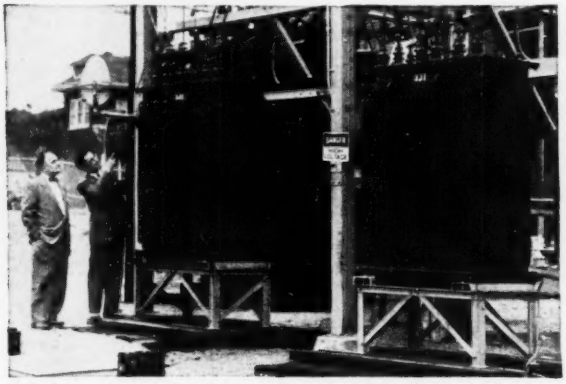
SIMPLEX TIREX

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.



IRS single-phase induction regulators supply the finest regulation obtainable for heavily loaded feeders where voltage variations are frequent and immediate response essential. Their sealed tank construction prolongs oil life.

ML32 step regulators provide low-cost dependable regulation on branch and rural circuits in thirty-two 5/8% steps. As with all G-E station-type voltage regulators, controls of the ML32 maintain Class I accuracy.



IRT three-phase induction regulators combine three single-phase IRS regulators in one tank with a single set of controls. They provide high quality stepless regulation for balanced loads. Rugged construction assures long life.

MLT32 three-phase step regulators adjust voltage in thirty-two 5/8% steps. Best suited for lines with balanced loads, they feature rugged simplicity in construction—accessibility and ease of maintenance of switching mechanism.

Solve any feeder voltage problem with one of these G-E regulators

You can get exactly the type of voltage correction you need . . . dependable, low-cost regulation . . . the finest regulation obtainable . . . for circuit capacities from 125 kva at 2.4 kv to 25,000 kva at 69 kv . . . by choosing from General Electric's complete line of voltage regulators.

G-E Induction Regulators, with their prompt response to voltage variations, smooth stepless control, and negligible maintenance, provide the highest quality regulation obtainable. They're available for circuits 15 kv and below, 3000 kva and below . . . single-phase for individual phase control . . . three-phase for balanced loads.

G-E Step Regulators offer economic advantages where you handle large blocks of power at higher voltages, and where you need supplementary regulation on your branch and rural feeders. G.E.'s MLT32 three-phase step regulator is available for all standard voltages up to 69 kv, circuit capacities up to 25,000 kva . . . ML32 single-phase regulators offer ±10% regulation in thirty-two 5/8% steps in ratings 13,800Y/7960 volts and below, for three-phase banks rated approximately 2000 kva and below.

For more information on IRS, IRT, MLT32, ML32 regulators, see your local G-E representative or send for bulletins GEA-2985, GEA-2985C-1, GEC-716, GEA-5752, respectively. General Electric Company, Schenectady 5, New York. 423-2

GENERAL ELECTRIC

three tapes
...one quality
GOLD SEAL

FRICTION
Get the most "coverage" for your money with tape that goes *further* . . . say Gold Seal.

RUBBER
Get the splicing compound that sticks fast, speeds the job . . . say Gold Seal.

PLASTIC Get Gold Seal quality in plastic electrical tape. Highly elastic, it "flows" on to cover any surface snugly. Neat, thin wrapping gives all needed dielectric on most jobs. Sticks on — stays on — resists sunlight and weather — defies water, oil, solvents. Single 60 ft. rolls, cellophane protected, are packed in round metal cans. "Tape-saver" 20 ft. rolls, sized to meet average job needs and "swing" easy in tight places, are packed in 10-roll Handy Pack containers. Sample free on request. Jenkins Bros., Rubber Division, 100 Park Ave., New York 17.

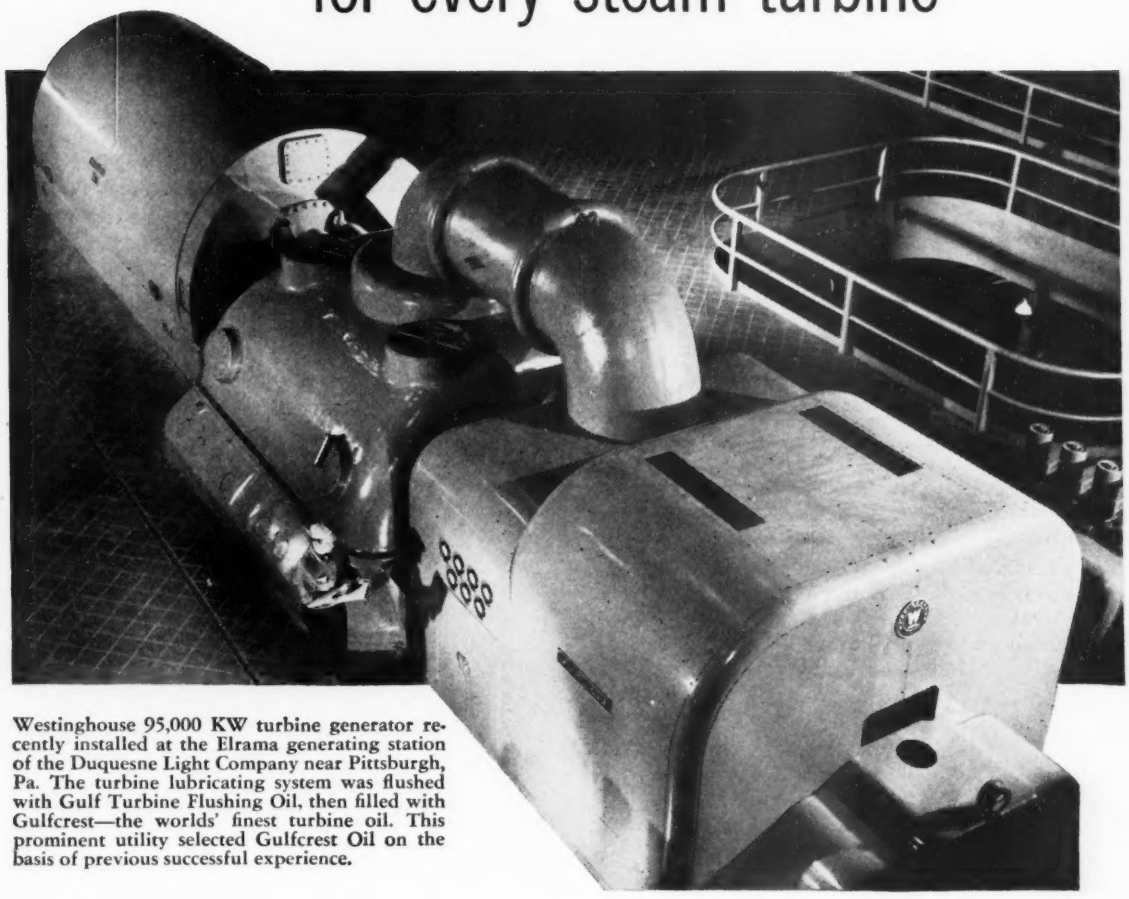
JENKINS

Gold Seal Tape

FRICTION • RUBBER • PLASTIC

Also Diamond Seal Friction and Rubber Tapes made to ASTM Specifications. Products of Jenkins Bros. — makers of famous Jenkins Valves.

GULFCREST is the right oil for every steam turbine



Westinghouse 95,000 KW turbine generator recently installed at the Elrama generating station of the Duquesne Light Company near Pittsburgh, Pa. The turbine lubricating system was flushed with Gulf Turbine Flushing Oil, then filled with Gulfcrest—the worlds' finest turbine oil. This prominent utility selected Gulfcrest Oil on the basis of previous successful experience.

the right base stock, Alchlor processed
the right combination and concentration of additives
the right background of performance

Gulfcrest Oil has a background of successful performance in every type and make of steam turbo-generator.

In many of these installations the original charge of Gulfcrest has been in service more than 10 years with no significant change in its original characteristics, and with neutralization numbers always remarkably low and safe.

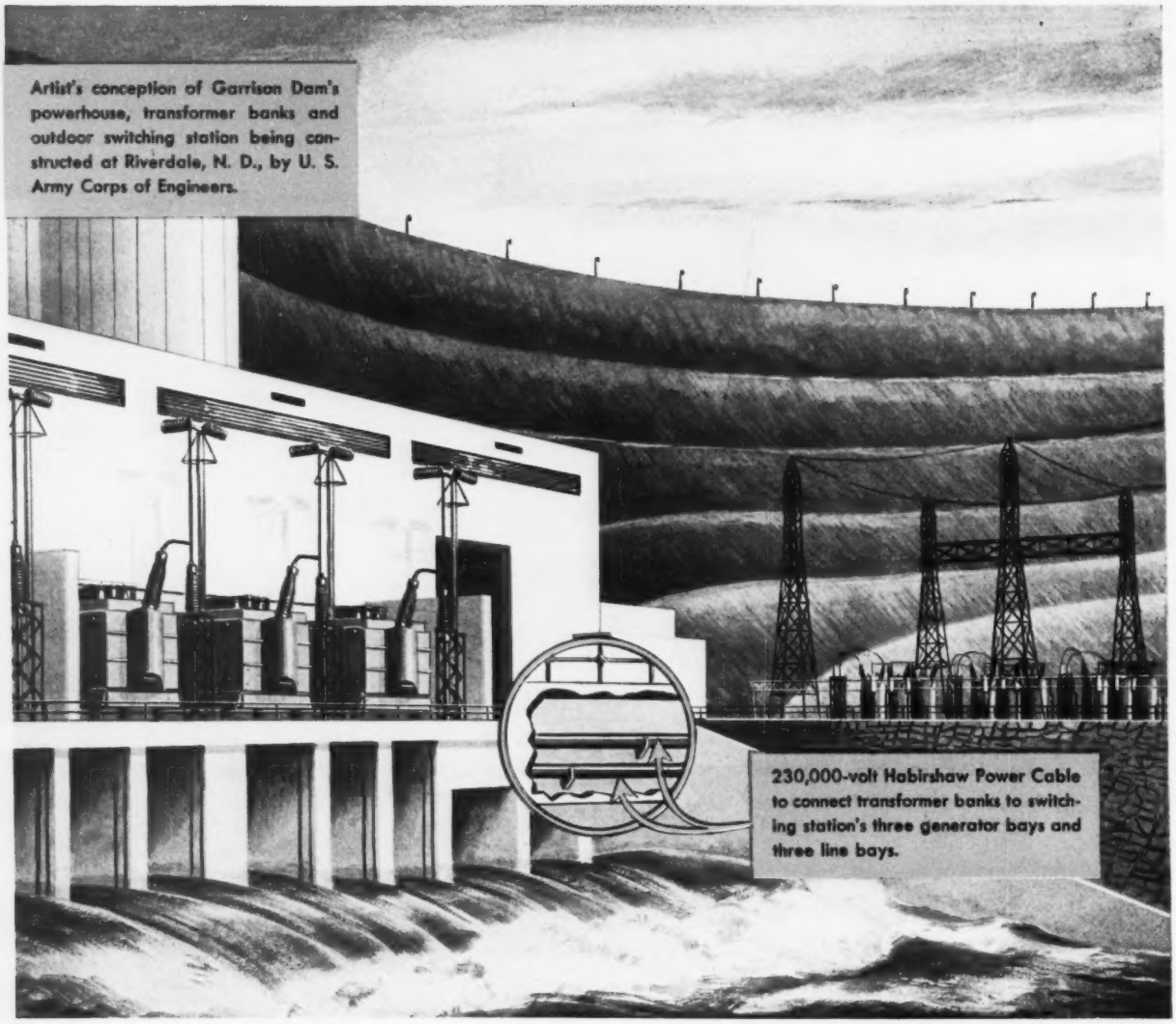
To get this kind of lubrication for your turbine, call in a Gulf Sales Engineer and ask him to recommend the proper grade of this superior oil. Write, wire, or phone your nearest Gulf office today.

Gulf Oil Corporation
Gulf Refining Company
Pittsburgh 30, Pa.

GULF SERVES INDUSTRY

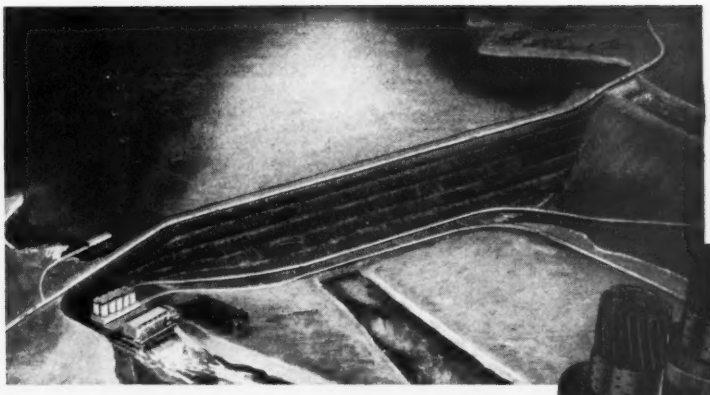
Phelps Dodge to supply new Garrison Dam

FIRST 230,000 VOLT POWER



Artist's conception of Garrison Dam's powerhouse, transformer banks and outdoor switching station being constructed at Riverdale, N. D., by U. S. Army Corps of Engineers.

230,000-volt Habirshaw Power Cable to connect transformer banks to switching station's three generator bays and three line bays.



with

CABLE IN THE U.S.!

Vital link for big Missouri River Dam will carry potential output of 400,000 kilowatts!

Habirshaw pipe-type power cable will provide a dependable and economical means of carrying this tremendous bulk of hydroelectric power at 230,000 volts, from the powerhouse to the outdoor switching stations.

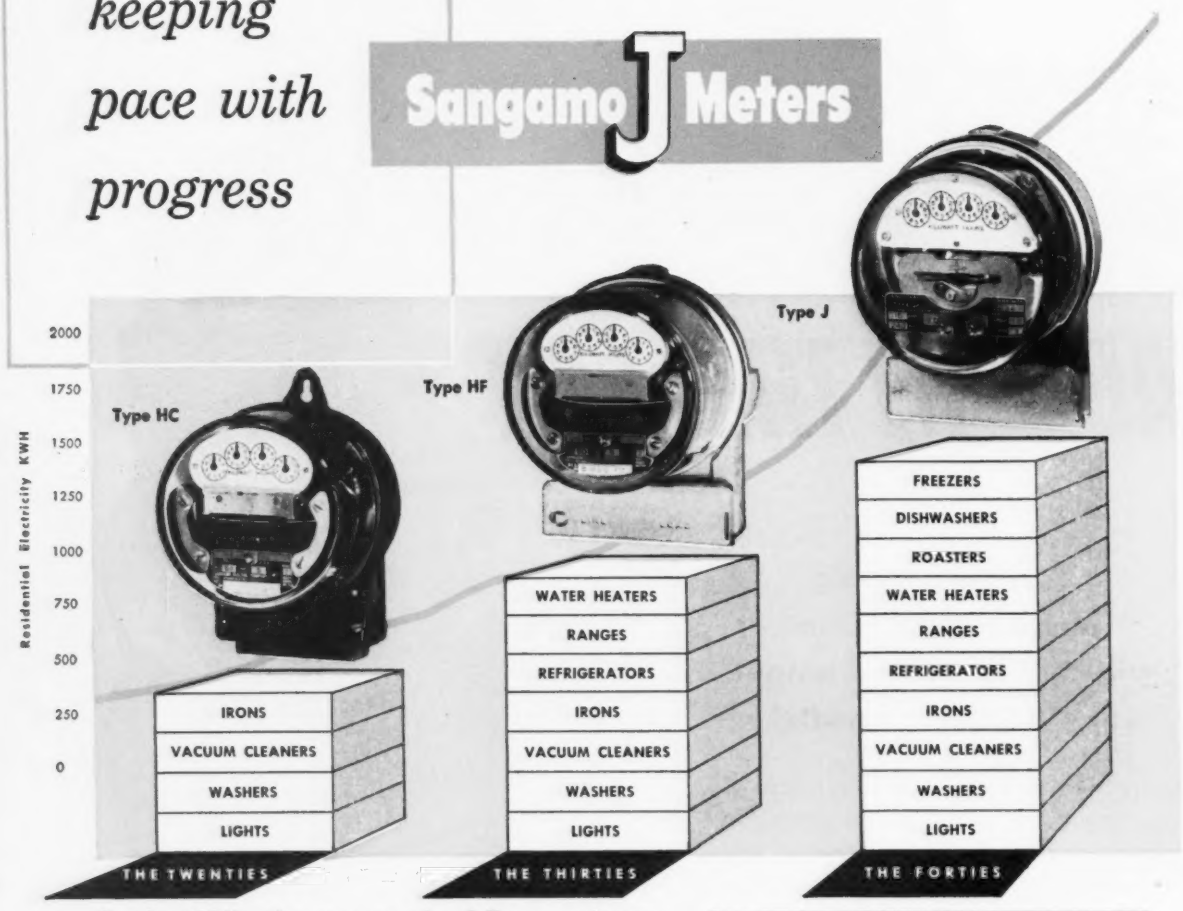
The cable, a product of Phelps Dodge Copper Products Corporation, will consist of three 500,000 circular mil copper conductors insulated with 835 mils of impregnated paper.

These insulated conductors will be pulled into pipes which will be filled with oil at a pressure of 200 pounds per square inch.

PHELPS DODGE COPPER PRODUCTS CORPORATION

keeping pace with progress

Sangamo J Meters

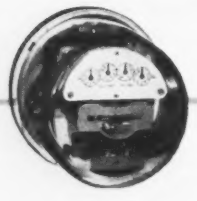


In the 1920's, the concept of a full-use customer was one with lights, an iron, and a vacuum cleaner. Today, the full-use customer has a range, water heater and many other major appliances.

Through these years, Sangamo Meters have been adequately measuring these growing loads. Since 1940, the Type J has provided completely accurate measurement of large domestic loads as well as the loads of the small-use customer.

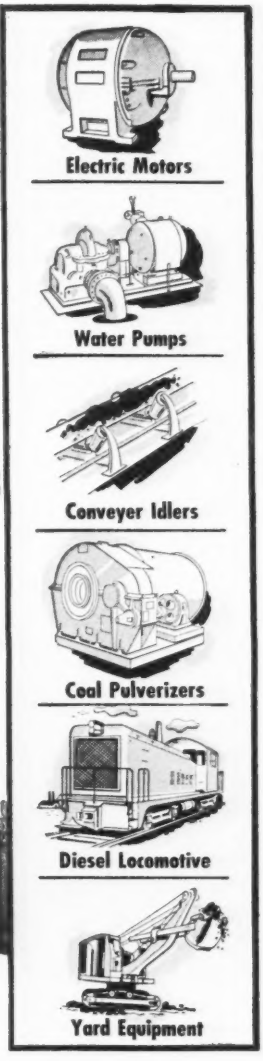
J Meters have met all requirements of the customer, the utility company and the meter superintendent. They have measured with great accuracy—have required little maintenance—and they have been easy to test and to repair.

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS



Only Measured Facts are Known Facts

"Indianapolis Power & Light Company's large new White River plant uses Shell Alvania Grease on every one of these grease applications!"



Check the multiple qualities of this remarkable lubricant

Shell Alvania Grease is effecting important improvements in plant maintenance and purchasing practice. In plant after plant, this one grease is replacing the many special purpose greases formerly used . . . for *every grease application in the plant!*

Look at these advantages:

1. Shell Alvania Grease flows *freely* in cold temperatures, yet will not run out of bearings under excessive heat.

2. Ideal for wet, humid applications . . . it resists water emulsification.

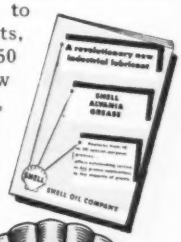
3. Shell Alvania Grease has extremely high oxidation stability.

4. You'll find that Shell Alvania Grease extends time between greasings . . . a substantial saving in labor and grease.

5. Simple inventory . . . just the one grease to stock and apply.

• • •

The economy of handling just one grease instead of *many* is an established fact. Write for the new booklet on Shell Alvania Grease . . . to Industrial Lubricants, Shell Oil Company, 50 West 50th Street, New York 20, N. Y.—or, 100 Bush Street, San Francisco 6, Calif.



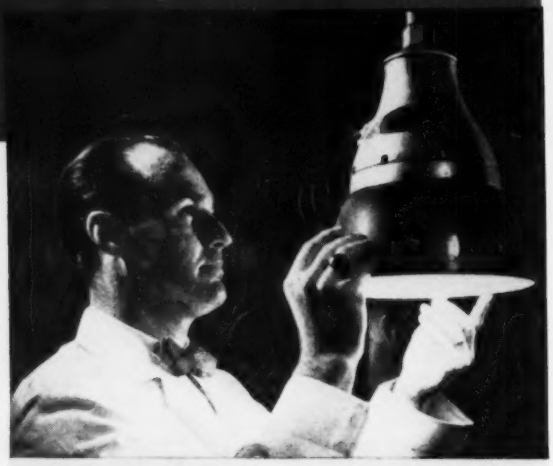
SHELL ALVANIA GREASE

The True Multi-Purpose Industrial Grease

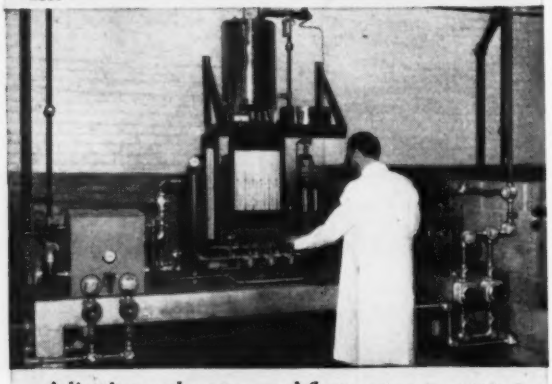
SHELL

Rigid testing of *Explosion-Proof* CONDULETS*

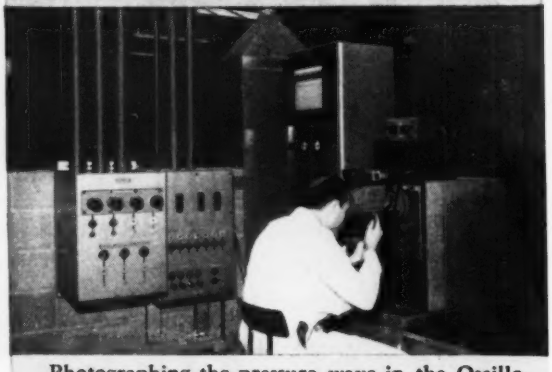
assures safety and long dependable service



Probing for maximum exterior operating temperature on a Type EVA Explosion-Proof Lighting Fixture using a multiple point recording potentiometer.



Adjusting carburetors and flow meters to create a predetermined explosive mixture within an explosion-proof Conduit for an explosion test.



Photographing the pressure wave in the Oscilloscope to determine the maximum explosion pressure within an explosion-proof Conduit that is behind the concrete wall.

Crouse-Hinds extensive laboratories and modern manufacturing combine to give you top quality

Laboratory testing is one of the key operations in the production of electrical equipment of the highest quality. Crouse-Hinds laboratories are equipped with the latest scientific instruments and staffed with expert technicians.

Products are constantly tested to make sure that they are being made to withstand field conditions. New devices are tested to predetermine their meeting or surpassing the requirements of Underwriters' Laboratories.

The photographs at the right show three of the many testing operations that are done in the Electrical Laboratory. It is equipped with apparatus for making both alternating and direct current tests, heat tests, pressure tests and many others.

Close cooperation between Crouse-Hinds laboratories and manufacturing departments is one of the reasons why Condulets have been the "Standard of Quality" for nearly fifty years.

Specify CONDULETS on every job. They're made right... to serve you better... and last longer.

When quality counts
... you can count on Condulets

CROUSE-HINDS COMPANY
Syracuse 1, N. Y.

OFFICES Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver Detroit — Houston — Indianapolis — Kansas City — Los Angeles — Milwaukee — New Orleans New York — Philadelphia — Pittsburgh — Portland, Ore. — San Francisco — Seattle — St. Louis — St. Paul Tulsa — Washington RESIDENT REPRESENTATIVES Albany — Atlanta — Baltimore — Charlotte Corpus Christi — Reading, Pa. — Richmond, Va. — Shreveport
Crouse-Hinds Company of Canada, Ltd., Toronto, Ont.

CONDULET
First in the field
STANDARD OF QUALITY

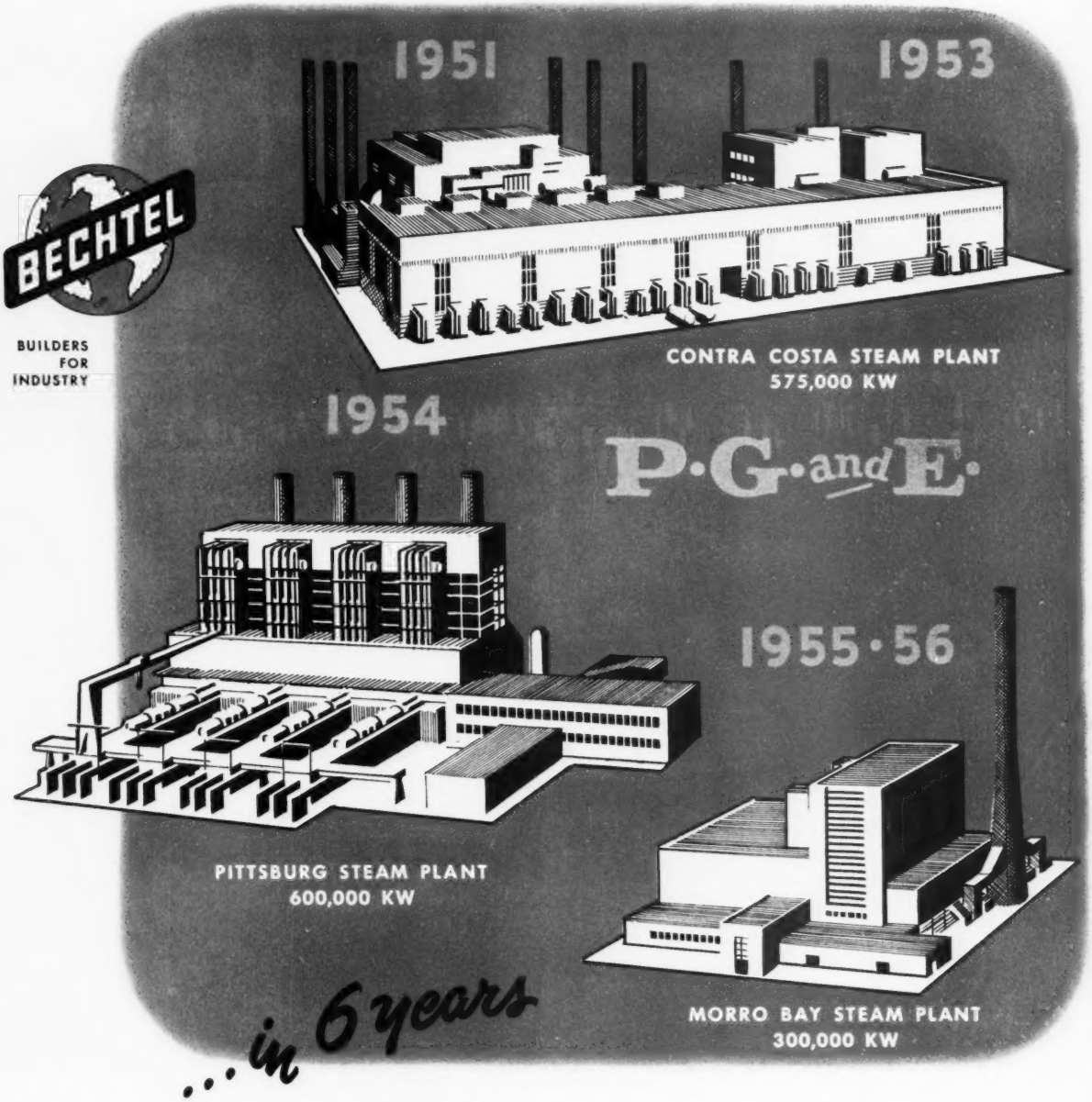
*CONDULETS are made only by CROUSE-HINDS

A Nationwide Distribution Through Electrical Distributors

CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS

BECHTEL

BUILDERS FOR INDUSTRY



...in 6 years

1½ MILLION KILOWATTS

FOR PACIFIC GAS AND ELECTRIC COMPANY

Expanding to serve growing California by building ahead of demand is basic policy with P.G.&E. Its postwar construction program has doubled generating capacity, will triple it in the next few years.

Bechtel is proud of its part in this program—three major steam-electric plants. Designed in collaboration with P.G.&E. engineers and constructed by Bechtel, these plants represent 1½ million kilowatts added to the system.

No business is more prized than repeat orders like these from a client of long standing, for they furnish a realistic appraisal of Bechtel service by those best qualified to judge.

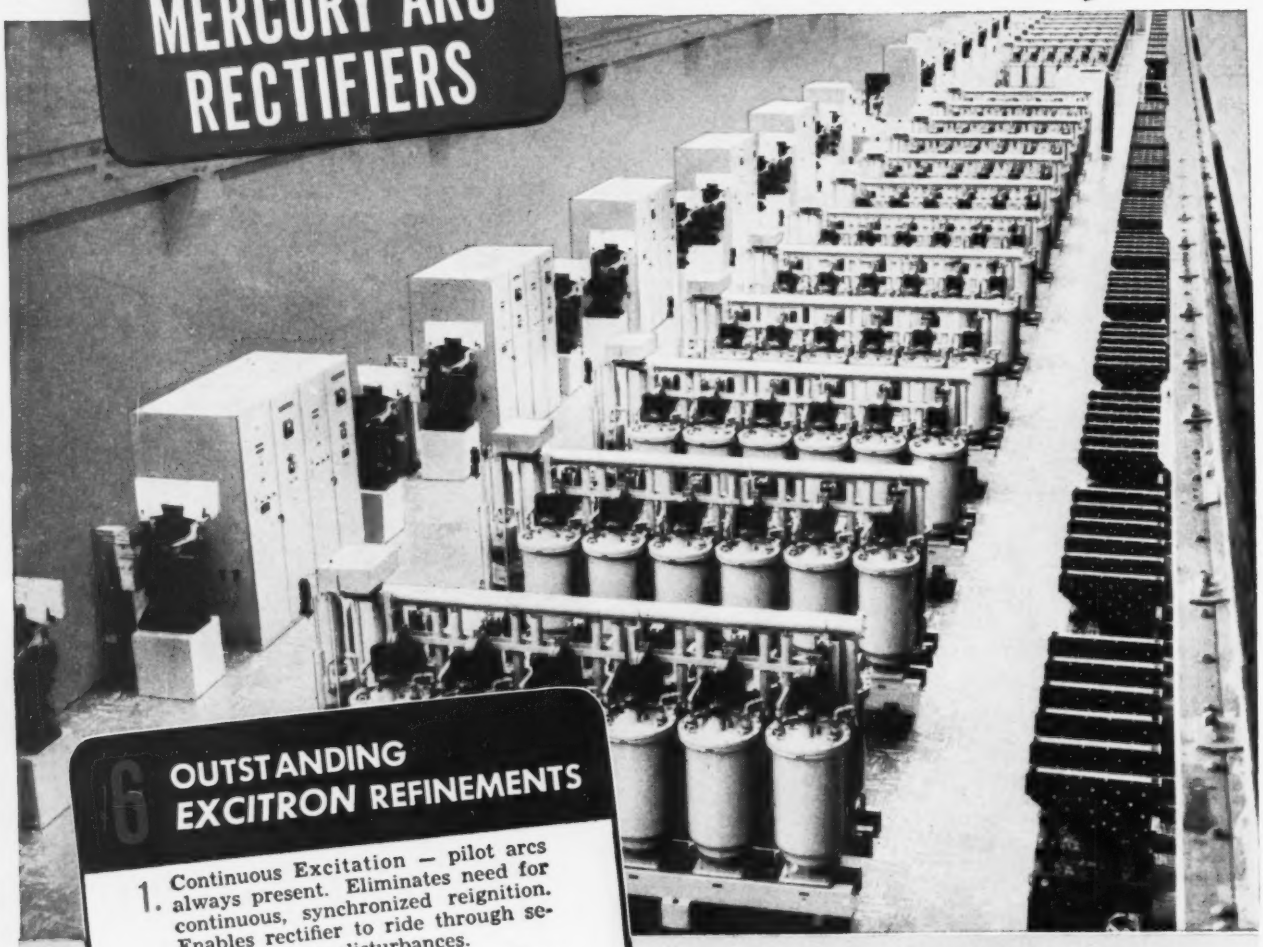
BECHTEL CORPORATION

Los Angeles · **SAN FRANCISCO** · *New York*

108,

ALLIS-CHALMERS

MERCURY ARC RECTIFIERS



6 OUTSTANDING EXCITRON REFINEMENTS

1. Continuous Excitation — pilot arcs always present. Eliminates need for continuous, synchronized reignition. Enables rectifier to ride through severe ac voltage disturbances.
2. Fixed Excitation Anode — doesn't contact cathode mercury and is independent of level, turbulence or impurities . . . requires no adjustment, maintenance or replacement.
3. Internal Cooling System — high heat transfer with seamless-tube cooling coil located within the rectifier.
4. Enameled Anode Seals — multi-layer fused vitreous construction provides high-strength seal unaffected by thermal variation.
5. Grid Phase Control — in cleaner region near anode, where ion density is lowest.
6. Arc-over Free Tube — insulating entire arc path eliminates danger of arcing-over to tube.

A view of the rectifier room at ALCOA's Wenatchee plant. Shown are twenty-four 6000-amp, 750-volt rectifier assemblies connected in pairs to twelve 10,000-kva outdoor rectifier transformers. Each transformer and two rectifier assemblies form a 9000-kw conversion unit.

At the left are cathode breakers and rectifier control cubicles — on the right, high speed anode breakers.

ALLIS-

000 kw
of Reliable DC Power

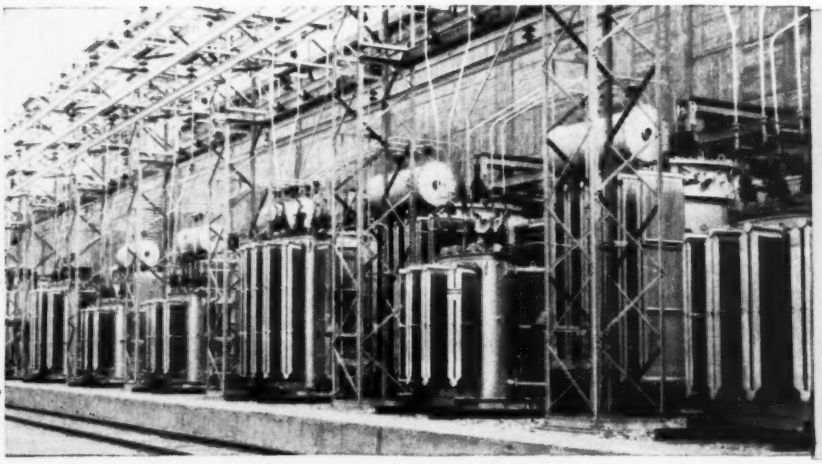
Allis-Chalmers Excitron Rectifiers Provide Dependable, Efficient Power Conversion for Newest ALCOA Plant

AT THE RECENTLY COMPLETED WENATCHEE, WASHINGTON PLANT of the Aluminum Company of America, A-C *Excitron* mercury arc rectifiers are providing dependable and efficient power conversion for smelting of aluminum oxide into aluminum.

The aluminum smelting process requires dependable dc power 24 hours a day. Any interruption in this power supply can cause freezing of the molten metal, resulting in serious damage and production loss. And because 9 to 10 kwhr of dc power are required for production of each pound of aluminum, high conversion efficiency is essential for low cost aluminum oxide smelting.

Allis-Chalmers *Excitron* rectifiers are designed and engineered for dependable and efficient operation in every type of industry. They combine the high service reliability, efficiency and low maintenance characteristics of mercury arc rectifiers with additional A-C refinements . . . Continuous Excitation, Fixed Excitation Anode, Internal Cooling System, Enameled Anode Seals, Grid Phase Control, Arc-over Free Tubes.

Whatever your power conversion requirements may be, you can rely on A-C mercury arc rectifiers for dependable and efficient service. For complete information on Allis-Chalmers rectifiers for your plant, contact your nearest A-C sales office or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4156



A part of the outdoor transformer yard showing 10,000-kva rectifier transformers and phase shifting autotransformers which produce a 36-phase system. Main 13.8-kv, 3-phase aluminum I-beam section busses supplying all transformers are suspended from crossarms of superstructure with air-break disconnecting switches mounted on top.

CHALMERS

A-C ALLIS-CHALMERS

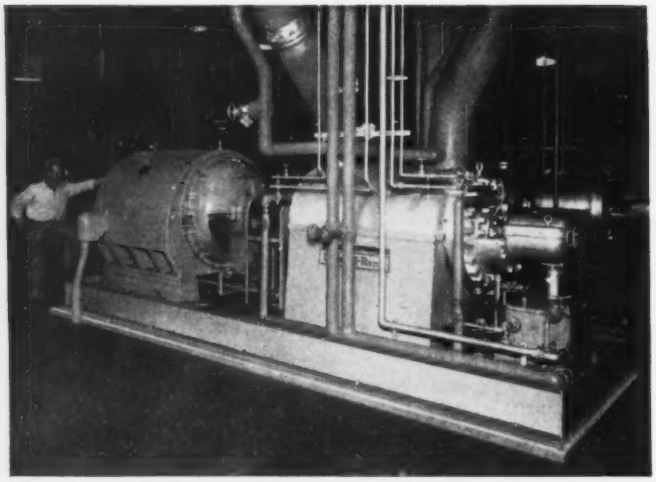
Our Engineers Introduced Mercury Arc Rectifiers to U. S. Industry

Contributing to the

of New England Electric System's

Ingersoll-Rand

CONDENSERS AND ACCESSORIES
BOILER FEED PUMPS
GENERAL SERVICE PUMPS
SOOT BLOWING COMPRESSORS



One of six Ingersoll-Rand 9-stage double-case boiler feed pumps serving the Salem Harbor Station. A 4th stage take-off delivers 778 gpm at 2170′ total head for attemperating service. The last 5 stages deliver 730 gpm at 2620′.

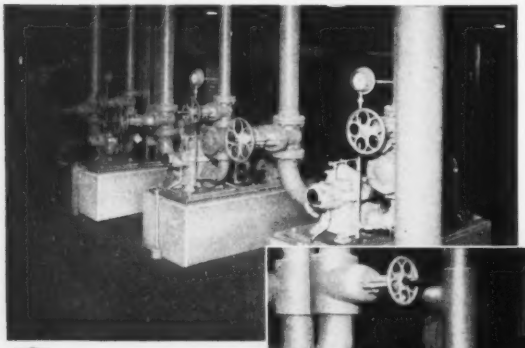
New England Electric System's Salem Harbor Station at Salem, Mass. is a fine example of the best in modern central station design. New England Power Service Company and United Engineers and Constructors, Inc. collaborated on the station's design, the latter firm doing the construction.

This station combines high operating economy with maximum continuity of service. That calls for *proved* economy and dependability in every item of equipment in this 150,000 kw plant.

That's why Ingersoll-Rand is pleased to have been called on to supply so much of the auxiliary equipment serving both units at Salem Harbor Station. Major items of this equipment are shown in the accompanying photos.

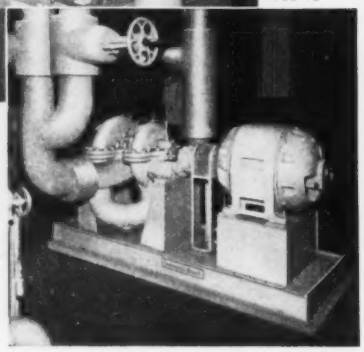
For *dependability*, operating economy and low maintenance, it pays to install Ingersoll-Rand central station auxiliaries.

Ingersoll-Rand
Cameron Pump Division
11 Broadway, New York 4, N. Y.



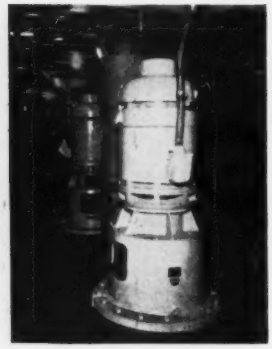
Three I-R single-stage general service pumps supply cooling water for various station equipment.

955-10

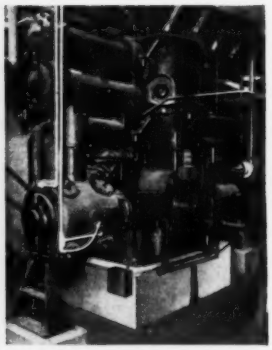


This I-R two-stage pump, rated at 1500 gpm and 270′ total head, is on city water booster service.

Two I-R two-stage, vertical turbine pumps handling service water.

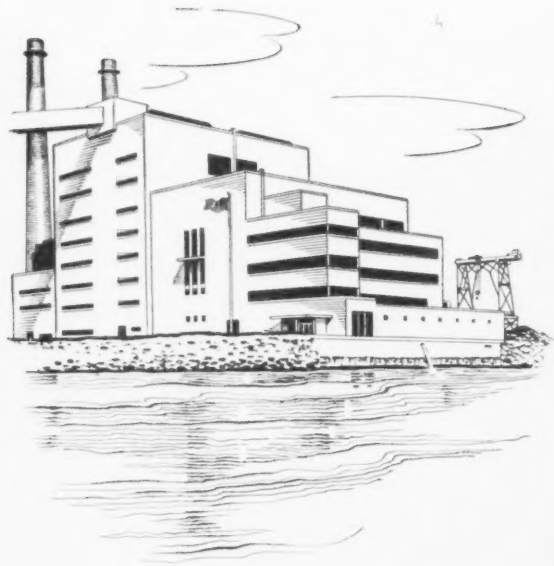


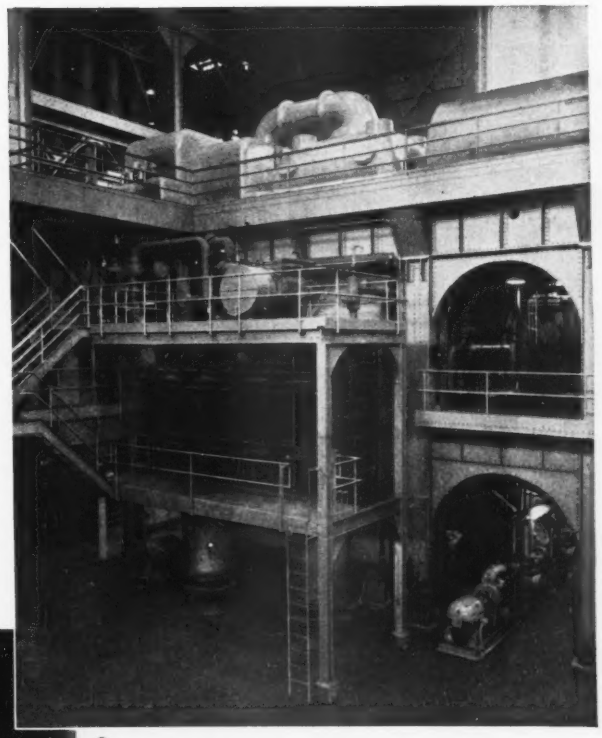
One of three I-R Class TVH 3-stage, 500 psi soot blowing compressors.



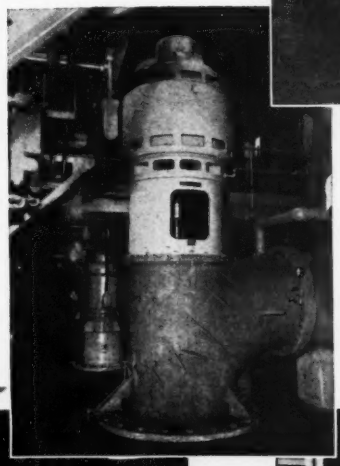
Dependability

SALEM HARBOR STATION



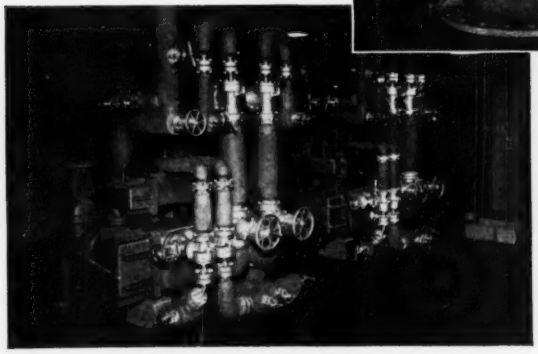


Unit 2 of the Salem Harbor Station, showing the 47,500 sq. ft. I-R rectangular steam condenser under the 75,000 kw turbo-generator. A duplicate condenser serves Unit 1.

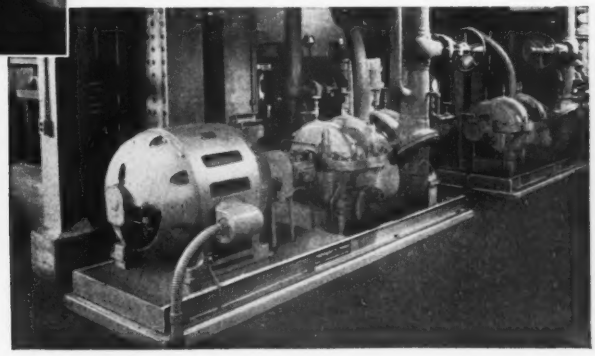


One of four I-R single-stage vertical condenser circulating pumps which each deliver 54,000 gpm to the condensers at Salem Harbor.

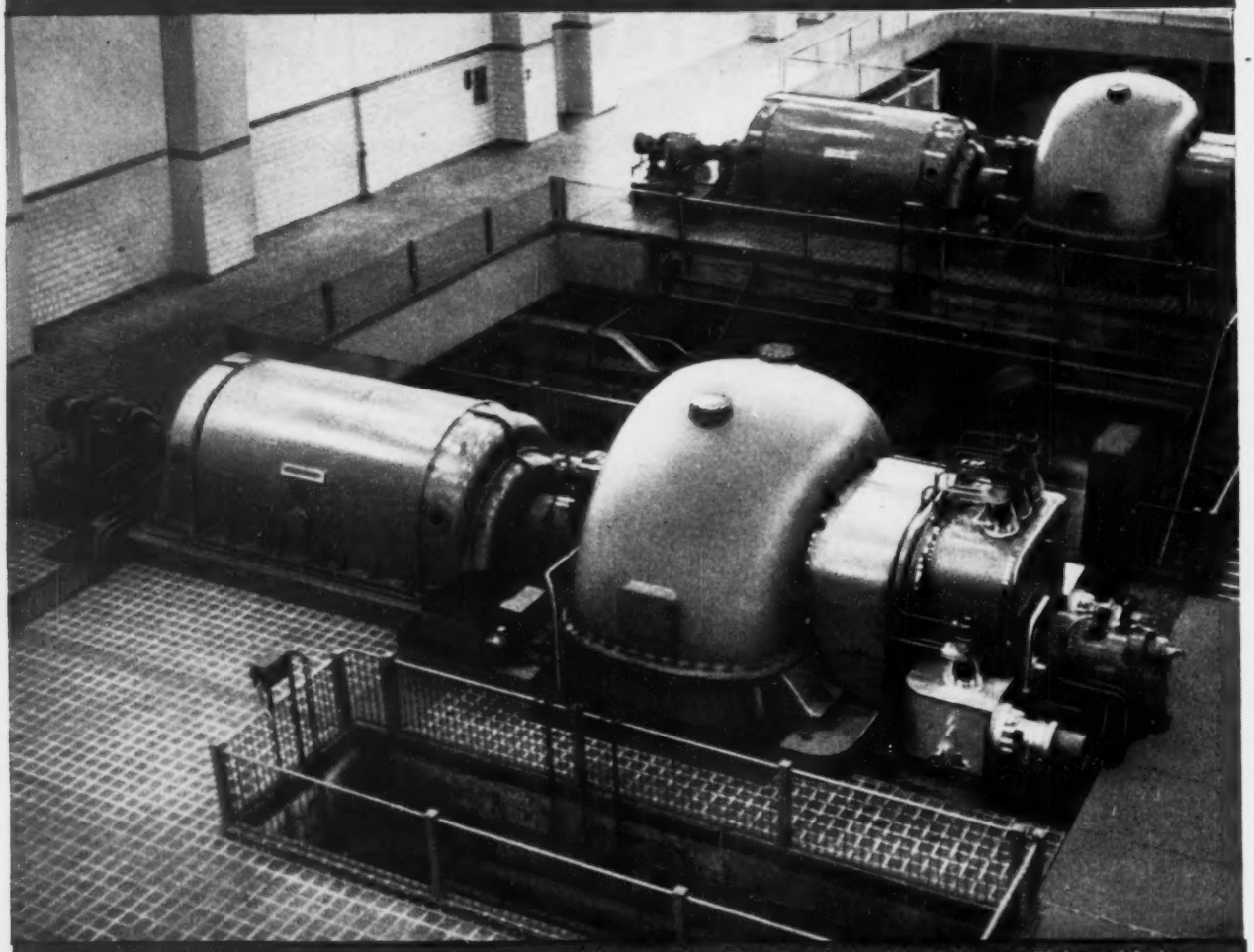
These two-stage steam jet air ejectors remove non-condensables from the steam condenser for Unit 2.



Two of the four I-R horizontal condensate pumps which serve the two condensers at the Salem Harbor Station. Each pump is rated 1,000 gpm, 465′ total head and 1180 rpm.



BROWN



View in the Cleveland Municipal Power Plant with its new Brown Boveri 25,000/32,500 kW turbo-generator sets. The City of Cleveland saved enough on the two units to purchase a third generator if so desired. These units were produced and delivered as scheduled.

Initial economy is not the only factor involved in the selection of Brown Boveri power generating equipment. The proven quality and operating economies of these turbo-generators — evidenced by the consistently dependable, year-after-year performance of similar Brown Boveri equipment — are equally major considerations.

It will pay you to investigate Brown Boveri turbo-generator sets.

Write for complete data.

BROWN BOVERI

BROWN BOVERI

19 RECTOR STREET,

BOVERI

TURBO-GENERATOR SETS . . .

"They saved the City of Cleveland over $500,000 in initial cost alone."

says:

EMIL J. CROWN
Director of Public Utilities, City of Cleveland
Cleveland, Ohio

"We have every reason to believe that the two Brown Boveri turbo-generator sets now installed in the City of Cleveland power plant, will meet our every expectation. They saved the City of Cleveland over $500,000 in initial cost alone."

CORPORATION
NEW YORK 6, N. Y.

Wagner
TRANSFORMERS
...the choice of leaders
in industry

Specify Wagner

They meet the NEW EEI-NEMA standards

and offer many PLUS features

No matter how varied your requirements may be, the Wagner line of Distribution Transformers will meet those requirements. *The line includes every rating and design listed in the EEI-NEMA Fifth Report.* When you specify WAGNER, you know that you'll get all the standardized electrical and mechanical features that mean easier installation and greater convenience in handling and maintenance . . . But you'll get PLUS values, too! All Wagner pole-type single-phase transformers in ratings 167 kva and below are furnished with the Wagner Form W element that permits a liberal design in small size, light weight transformers that give excellent electrical performance. All Wagner pole-type transformers in round tanks have covers sealed to the tank with the Wagner SHUR-SEAL Clamping Ring that prevents "breathing" and gives true sealed-tank construction. You get extra years of service-free transformer life because Wagner Distribution Transformers are filled with an inhibited oil to reduce oxidation and retard the formation of acids and sludge.

When you specify WAGNER, you get the benefit of improved design, better performance and longer transformer life. And in addition—Wagner has a nationwide organization to provide fast, convenient service, with branches in 32 principal cities.

Get in touch with your nearby Wagner branch today. Write for your copy of Bulletin TU-180. It gives complete information on Wagner Distribution Transformers.

®Wagner
Electric Corporation
EST. 1891

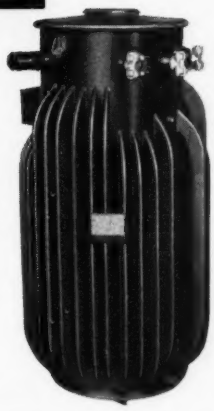
WAGNER ELECTRIC CORPORATION
6458 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

Distribution Transformers

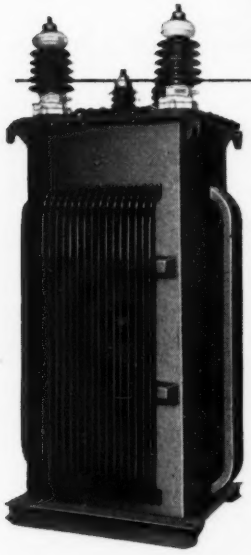
SINGLE-PHASE



Wagner

TYPE HEB

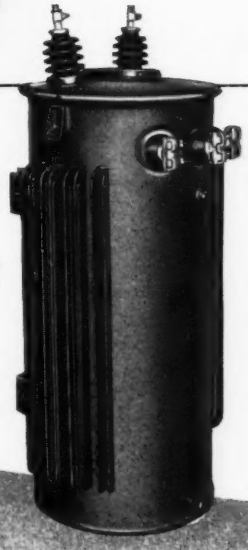
100 Kva, 2400/4160Y to 120/240 volt transformer shown.



Wagner

TYPE HEL

333 Kva, 34400 to 7200 volt transformer shown.



Wagner

TYPE HEK

50 Kva, 12000 to 120/240 volt transformer shown.

THREE-PHASE

Wagner

TYPE HPB VERTICAL

112.5 Kva, 2400 to 208Y/120 volt transformer shown.

Wagner

TYPE HPK

225 Kva, 7200 to 240 x 480 volt transformer shown.

Wagner

TYPE HPB

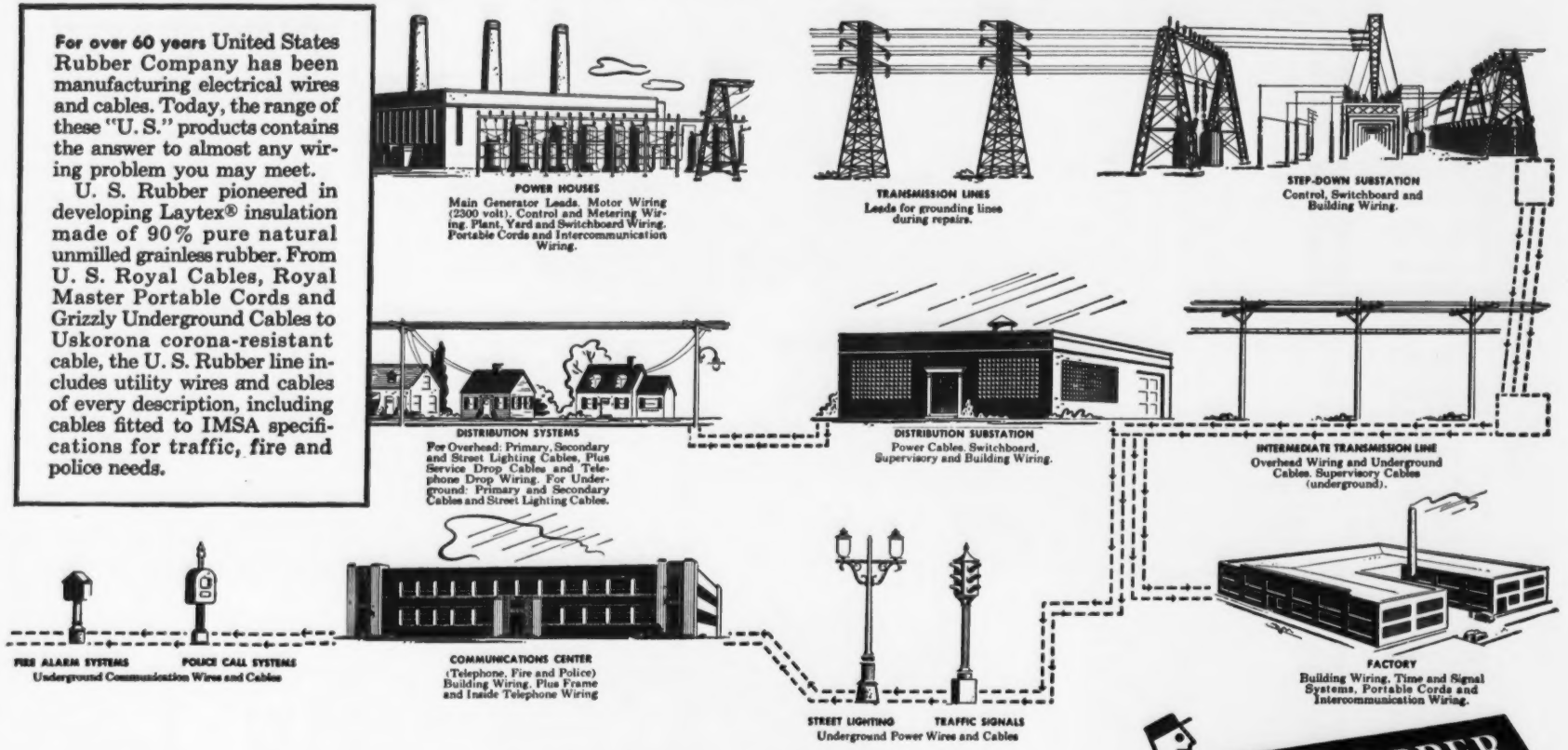
75 Kva, 2400 to 240 x 480 volt transformer shown.

T53-13

You can solve any power puzzle
with U. S. Rubber Electrical Wires and Cables

For over 60 years United States Rubber Company has been manufacturing electrical wires and cables. Today, the range of these "U. S." products contains the answer to almost any wiring problem you may meet.

U. S. Rubber pioneered in developing Laytex® insulation made of 90% pure natural unmilled grainless rubber. From U. S. Royal Cables, Royal Master Portable Cords and Grizzly Underground Cables to Uskorona corona-resistant cable, the U. S. Rubber line includes utility wires and cables of every description, including cables fitted to IMSA specifications for traffic, fire and police needs.


POWER HOUSES
Main Generator Leads. Motor Wiring (2300 volt). Control and Metering Wiring. Plant, Yard and Switchboard Wiring. Portable Cords and Intercommunication Wiring.
TRANSMISSION LINES
Leads for grounding lines during repairs.
STEP-DOWN SUBSTATION
Control, Switchboard and Building Wiring.
DISTRIBUTION SYSTEMS
For Overhead: Primary, Secondary and Street Lighting Cables, Plus Service Drop Cables and Telephone Drop Wiring. For Underground: Primary and Secondary Cables and Street Lighting Cables.
DISTRIBUTION SUBSTATION
Power Cables, Switchboard, Supervisory and Building Wiring.
INTERMEDIATE TRANSMISSION LINE
Overhead Wiring and Underground Cables. Supervisory Cables (underground).
FIRE ALARM SYSTEMS
POLICE CALL SYSTEMS
Underground Communication Wires and Cables
COMMUNICATIONS CENTER
(Telephone, Fire and Police) Building Wiring, Plus Frame and Inside Telephone Wiring
STREET LIGHTING
TRAFFIC SIGNALS
Underground Power Wires and Cables
FACTORY
Building Wiring, Time and Signal Systems, Portable Cords and Intercommunication Wiring.

UNITED STATES RUBBER COMPANY

Electrical Wire and Cable Department, Rockefeller Center, New York 20, N. Y.

U.S.RUBBER
SERVING THROUGH SCIENCE

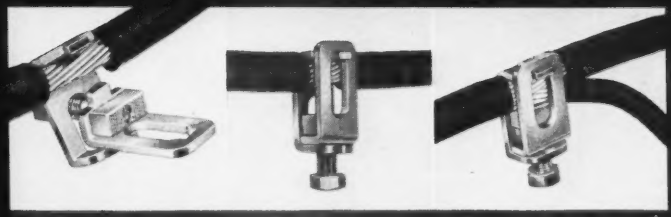
PRESENTING THE NEW

IDEAL Tap Connector

See the joint through the sides of the connector
Extra large pad for greater contact
Simple hex set-screw provides greater pressure

The First Major Improvement in Tap Connectors to Offer All These Advantages

Stronger Mechanically!
Easier to Use! Costs Less!
Only 3 Sizes Needed! Made of
Cold-Worked Steel, with Heavy Hot-Zinc Dip



ONE UNIT! No Loose Pieces to Fall Off!
YOU COULD DO THIS REINFORCED

The IDEAL Tap Connector is entirely new . . . designed and built to give you stronger tap connections, with less work and at lower cost per unit.

Unique Design . . . Takes fullest advantage of the greater strength of cold-worked steel, hot-zinc dipped, to make tightest connections without distortion or "bowing" of the connector.

Greater Contact Area . . . Extra large pad and stirrup distribute pressure and reduce deformation or cold-flow of wire — make low-resistance connection.

Greater Pressure . . . up to 1½ times as great as ordinary connectors.

THIS COMBINATION OF EXTRA MECHANICAL STRENGTH, GREATER CONTACT AREA AND GREATER PRESSURE ELIMINATES ALL CHANCE FOR WIRES TO WORK LOOSE, WITH RESULTING POOR CONTACTS AND POSSIBLE "BURN-OUTS".

Easier to Use . . . No parts to come loose or fall off, even in models using conductor spacers. Nothing but a wrench is needed – and you can actually see the joint from all sides.

1. Place IDEAL Tap Connector on main **2.** Close Connector **3.** Insert Tap and Tighten

THREE SIZES for all combinations from two No. 1 wires to 1 No. 10 and one No. 12 or one No. 8 and one No. 14.

WITH SPACER BARS for copper-to-aluminum, aluminum-to-steel or copper-to-steel.

WITHOUT SPACER BARS for copper-to-copper or aluminum-to-aluminum.

Costs Less . . . Lower priced than other connectors for practically every combination.

Easier to Stock . . . Three sizes handle a range of combinations requiring as many as seven sizes of ordinary connectors.

Versatile . . . Use them for street taps — service drops to service entrance — dead end loops — T-taps — transformer connections — machine tool connections — grounding connections, etc.

IDEAL

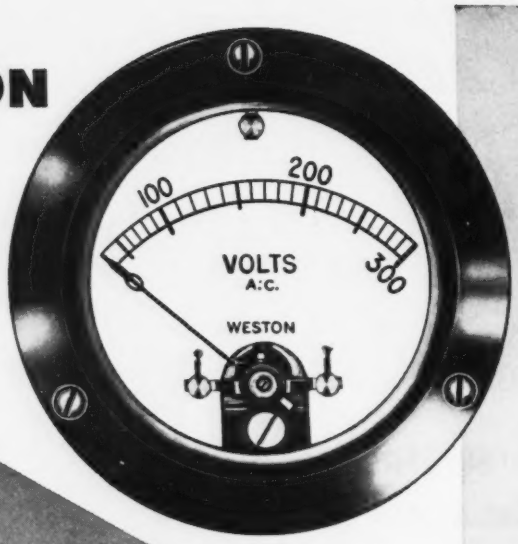
MAIL COUPON FOR FULL DATA
— How you can save money and have better tap connections.
Sold Through Leading Distributors

IDEAL INDUSTRIES, Inc., 1021 Park Avenue, Sycamore, Illinois

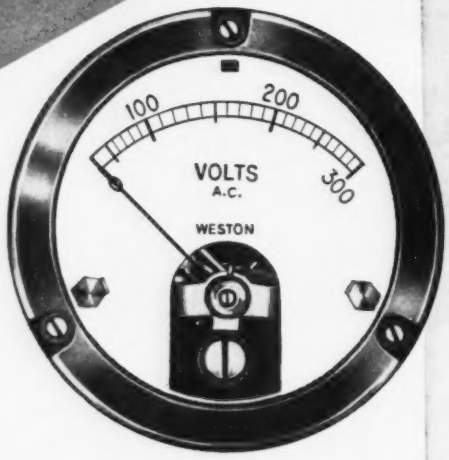
Please see that we get information on IDEAL'S new Tap Connector.

Name_____
Company_____
Address_____
City_____ Zone____ State_____

another WESTON FIRST



A-C ruggedized instruments



All Weston Ruggedized instruments have externally operated sealed zero correctors.

Insulated, breakproof connection terminals are molded into internal rubber.

Tough, flat plastic windows are really shock resistant.

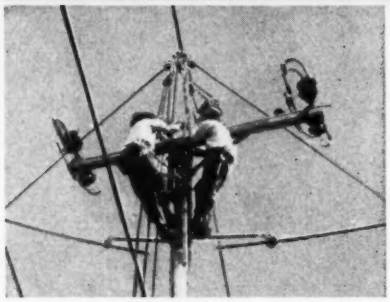
WESTON Ruggedized Instruments are available not only in D-C but in movable iron A-C, rectifier type A-C and thermo. *All* are supplied with essential sealed *zero correctors*—shock-resisting flat plastic windows—and connection terminals molded into internal rubber, *leakproof, breakproof and effectively insulated.* For complete details, write for bulletin. Weston Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, New Jersey.

WESTON ruggedized instruments

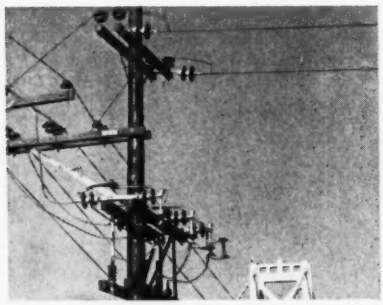
KPF

AIR BREAK SWITCHES

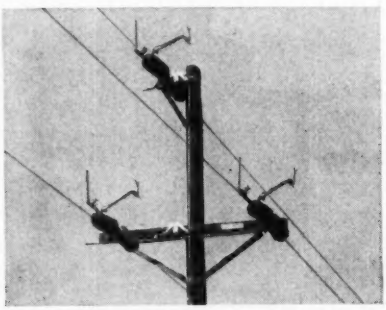
Standard for nearly half a century



Installing KPF Type A-202 switch hot on 12 kv line. KPF phase units are shipped completely assembled, ready for quick installation.

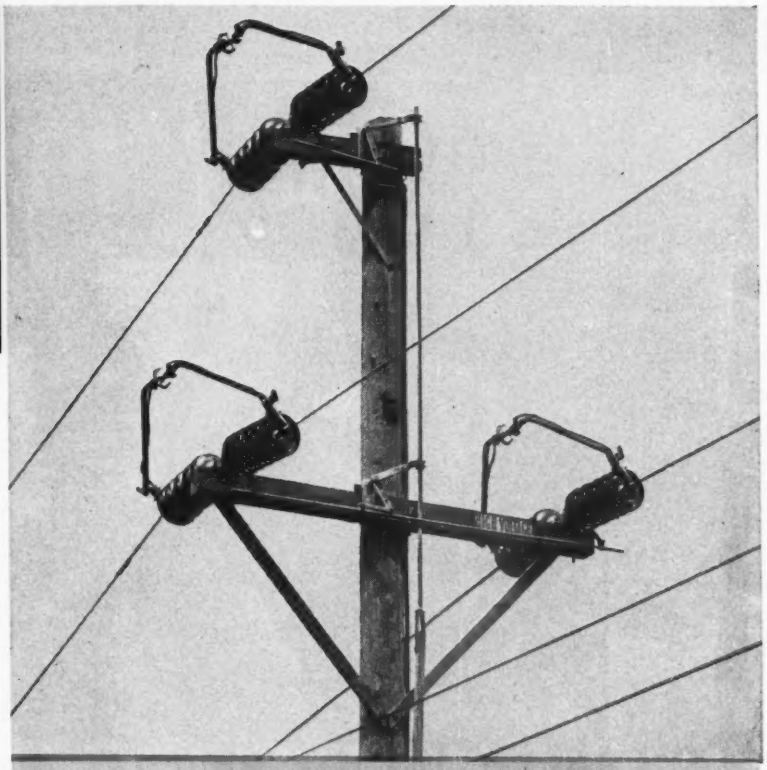


Horizontal-mounted KPF Type UF-2 switch in metropolitan service (P.G.&E., San Francisco). Versatile KPF switches operate equally well with or without line tension.



KPF Type S-205 switches with inexpensive Quick-Break attachment on 60 kv rural transmission line. Switch shown in open position.

2825



Basically different switch design proven in decades of service with leading utilities

Service-proved KPF switches look different because they *are* different.

Their simple, sturdy design insures freedom from mechanical failure or lubrication worries, and virtually eliminates maintenance. Self-aligning silver surfaced blades operate smoothly despite severe ice or crossarm warpage conditions. Installation is fast and economical—switches are bolted directly to crossarms on the ground or in the air. No separate strain insulators or extra crossarms are required; integral insulator stacks readily adjust to line sag.

KPF switches have been used for almost 50 years on lines ranging from 7.5 to 110 kv. Tens of thousands are in use today by Pacific Gas & Electric, Southern California Edison, Minnesota Power & Light and other leading power companies throughout the world.

For the world's simplest, surest, lowest cost air break switch, specify KPF—standard for nearly 50 years.

New catalog gives complete specifications, detail drawings, installation information.

KPF ELECTRIC COMPANY

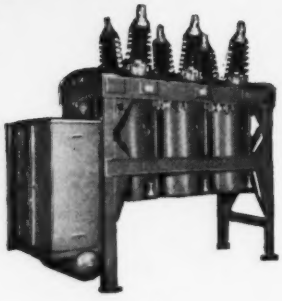
1624 East Alpine Avenue, Dept. E-1, Stockton 5, California

all ALLIS-CHALMERS breakers are

"FULLY MECHANICALLY

ALLIS-CHALMERS
PROGRESS IN
Switchgear

BZO breaker with Mechanically Trip-Free *Pneu-Draulic* Operator . . . introduced in 1953.



FZO breaker with Mechanically Trip-Free Pneumatic Operator.

ALLIS-

TRIP-FREE"

Compare an Allis-Chalmers operator with any other operator —see the many inherent advantages of the Allis-Chalmers design

NORMAL opening or closing of a breaker is seldom a problem. However, high-speed reopening following "closing-in" on a system fault may be delayed and lead to serious trouble — unless the operator is fully mechanically trip-free.

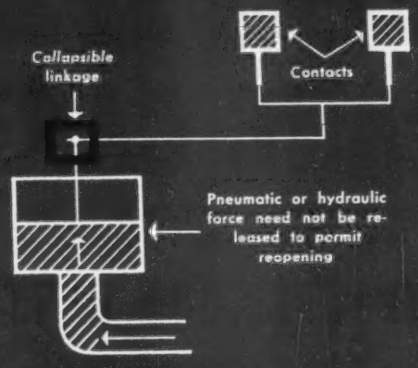
Check the schematic diagrams. Compare operation of Allis-Chalmers breakers and most other breakers when reopening after closing against a fault . . . and see the inherent advantage of Allis-Chalmers operator design.

Since tripping is the most vital function of a breaker, don't compromise. Be sure your next breaker has fully mechanically trip-free operation! Call your nearby Allis-Chalmers district office. Or write Allis-Chalmers, Milwaukee 1, Wis.

A-4177

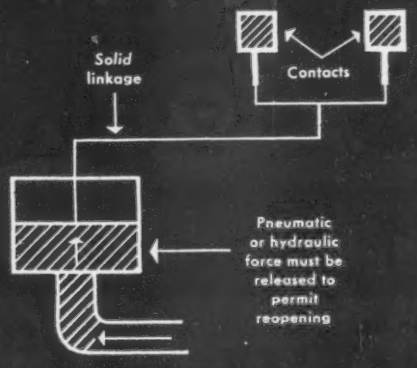
Pneu-Draulic is an Allis-Chalmers trademark.

Schematic Diagrams Show Basic Difference in Breaker Operators



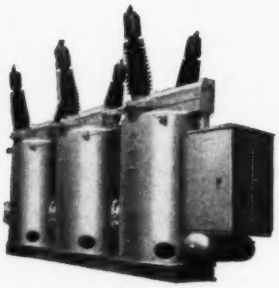
Allis-Chalmers Mechanically Trip-Free Mechanism

With Allis-Chalmers operator, dumping of air or oil pressure is not necessary. Trip coil simply releases a latch and the whole closing mechanism collapses, allowing contacts to open without delay. Operation is fully mechanically trip-free.



Other Operating Mechanisms

Air or oil pressure used to close breaker must be dumped — fast — to permit contacts to open. To do this takes a whole sequence of devices, including valves and solenoids. Everything must work properly or breaker will be held closed or delayed in opening.



BZO breaker with Mechanically Trip-Free Pneumatic Operator . . . introduced in 1927.

CHALMERS

A-C ALLIS-CHALMERS

ANNOUNCING...

SCHIELD Bantam's® BRAND NEW *All New*

CRANE CARRIER

For use with the Model T-35 BANTAM... the latest development in shovel-cranes.

LIFTS 12,000 LBS.!

LOW PRICED ONLY

$12,750

Complete, as Illustrated F.O.B. Factory

Lower price if Crane Carrier Extras such as double out-riggers and fenders not desired. (Price subject to change)

This brand new Crane Carrier, exclusively engineered for BANTAM mounting by a leading and famous truck manufacturer, answers the demand for all-new truck crane equipment with high-speed mobility. It's built right — and priced right!

This, too, is *ALL NEW!*

The Great C-35

CRAWLER

5-ton . . . ⅜ cu. yd.

Yours for only **$10,330**

Complete Crawler Back Hoe with 30" bucket, f.o.b. Factory. (Price Subject to Change)

Now . . . BANTAM Offers Any Type of Mounting You Want

The versatile, job-proved BANTAM which has established enviable records of economy on all kinds of lifting and excavating jobs everywhere is now available with a wide choice of mountings, letting you select the best suited combination to handle your jobs faster and at far less cost.

Today, you can get a BANTAM with a brand new, all-new Crane Carrier as illustrated . . . or mounted on a factory guaranteed re-built truck. Or, to save yourself more money, a BANTAM can be field-mounted on YOUR TRUCK.

But, that's not all! Then, to meet your needs for a top quality, low-priced ⅜-yard crawler shovel-crane, Schield BANTAM now offers the new Model C-35 . . . it's the revolutionary crawler everyone's talking about! And, best of all — no matter which type of mounting your work calls for, the complete BANTAM with any one of 9 fast-change front-end attachments is still the lowest priced, ⅜-yard, 6-ton shovel-crane on the market.

Investigate the BANTAM method . . . find out how a BANTAM lets you bid lower and get more work. Ask for a free demonstration on your job. See your nearest Schield BANTAM Distributor or contact the factory, TODAY!

SCHIELD BANTAM CO.
287 Park St., Waverly, Iowa

T-35 with Crane Carrier for fast job-to-job moves

T-35 BANTAM mounts on factory re-built 6 x 6 or on Your Truck.

ANOTHER NEW PRODUCT OF THE

SCHIELD Bantam Co.

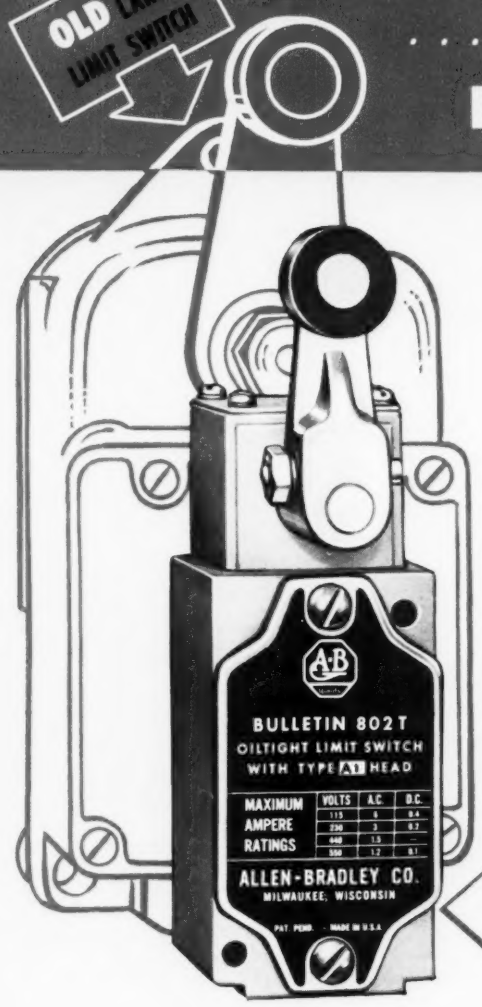
WORLD'S LARGEST PRODUCERS OF TRUCK-CRANES AND EXCAVATORS

OVERSIZE

IS OFTEN A HANDICAP

. . . . . *especially in*

LIMIT SWITCHES



Limit switches are intended for switching pilot circuits only. Hence, nothing is gained in making limit switches large and heavy. In fact, the excessive impact of high inertia, oversize parts may actually shorten the working life of the moving elements and contacts.

Look at the new, compact Allen-Bradley limit switch. Compare it with the old, oversize unit. The new limit switch has no useless bulk . . . no excess weight . . . yet it is good for millions of trouble free operations.

Quickly Adapted to Any Location . . .

The Bulletin 802T oiltight limit switch has double break, maintenance free, silver contacts.

Various operating heads are available with different types of push rods and levers. Limit switches in flush type construction can also be furnished.

The operating heads may be mounted in any one of four positions to fit any location on your machines. Since operating heads are interchangeable, the heads and bases may be stocked separately . . . and thus simplify your inventory problems.

NEW SMALL A-B LIMIT SWITCH

The Bulletin 802T oiltight limit switch is a real pacemaker in up-to-the-minute design and performance. It is rated for operation on alternating or direct current at 115, 230, 440, and 550 volts. If you use limit switches, by all means send for our illustrated Bulletin 802T which shows the various types of operating heads available for various limit switch applications.

A-B Quality

Allen-Bradley Co., 1316 S. Second St.
Milwaukee 4, Wisconsin

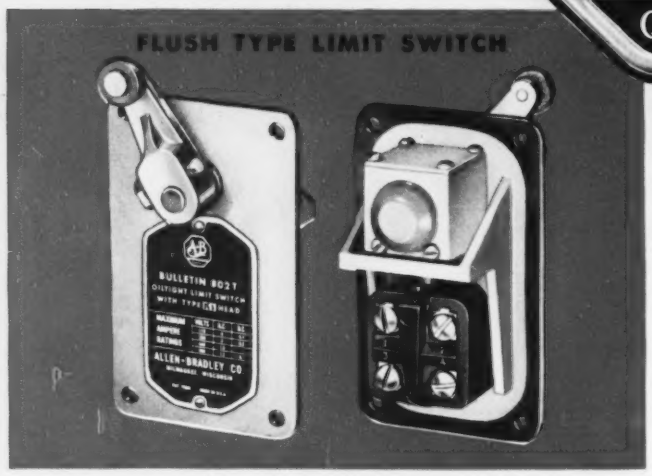
ALLEN-BRADLEY
QUALITY
LIMIT SWITCHES

9-53-MR

OILTIGHT LIMIT SWITCHES

A-B Quality

The Sign of Quality in Motor Control



The operating head, with lever or push rod, may be set in 4 horizontal locations, each 90 degrees apart.

A COMPLETE LINE OF COMPACT, DEPENDABLE LIMIT SWITCHES FOR OILTIGHT MACHINE TOOL SERVICE

Operating heads are available with various push rods and levers. The switch is a single pole, snap acting unit, with one normally open and one normally closed contact, electrically separated. Most of these limit switches can be supplied for spring return or maintained contact operation.

The compact, streamlined design of these Bulletin 802T limit switches marks a new advance in motor control engineering.

The name plate cover has a synthetic rubber gasket to exclude oil. Terminals are easily accessible by removing the name plate. The switch body is threaded for ½ inch conduit. Let us send a sample for your inspection.

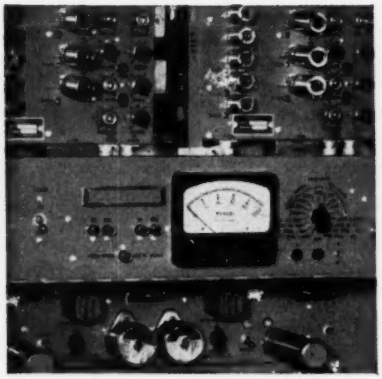
Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.

Bulletin 802T oiltight limit switches can be mounted from the front, using the two clearance holes shown above. For mounting from the back, two tapped holes are provided in opposite corners.

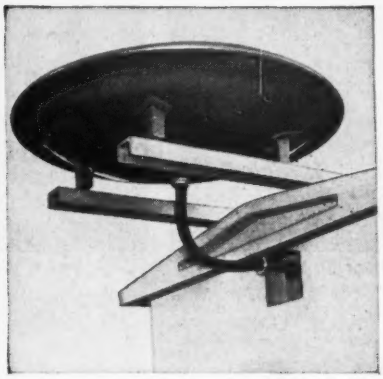
ALLEN-BRADLEY
QUALITY
LIMIT SWITCHES

9-53-MR

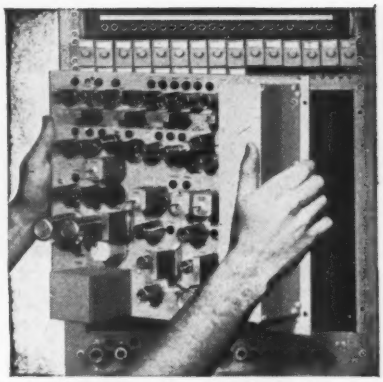
PHILCO MICROWAVE CUTS COMMUNICATIONS COST



TEST JACKS AND BUILT-IN METERING
Field circuit analysis simplified by built-in metering and test points on every major circuit for instantaneous monitoring of any current or voltage.



ANTENNA-REFLECTOR SYSTEM
Tower climbing eliminated for routine checks since antennas are mounted at ground level, easily accessible for maintenance.

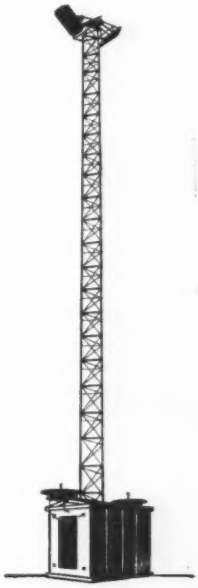


"PACKAGED UNIT" COMPONENTS
Field maintenance time and cost saved. All assemblies removable with only the use of a screwdriver for quick field replacement and depot checkout.

Reduce your communications cost with Philco microwave. Thousands of your communications dollars will be saved by the cost cutting features built into each Philco unit. Philco engineers know there is no substitute for quality and low maintenance cost.

That is why Philco microwave is built to Joint Army-Navy Specifications and why Philco's exclusive design slashes field maintenance time with built-in metering and test points on all major circuits . . . eliminates tower-climbing for routine checks with passive reflector-antenna system... allows quick field replacement of major assemblies with Philco's exclusive "packaged unit" components, removable with only a screwdriver.

Look to Philco microwave to cut your communications cost.



For full information write to Department EW

PHILCO Famous for QUALITY the World Over

PHILCO CORPORATION

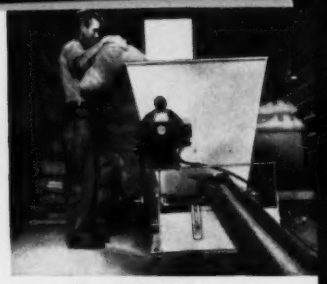
GOVERNMENT & INDUSTRIAL DIVISION

PHILADELPHIA 44, PA.

Urban Transit

Outdoor Recreation

Barn Hay Curing

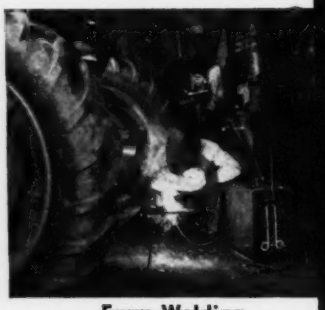


Electrified Farming

Sewage Treatment

Water Supply

Farm Water Supply



Farm Welding

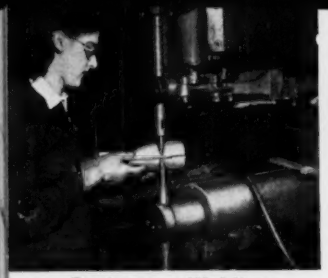
21 dramatic film programs to help you build load, get community action

LATEST ELECTRICAL IDEAS and techniques are dramatically portrayed in the twenty-one film programs shown here. You can use them to build industrial and farm electrification, promote community improvement.

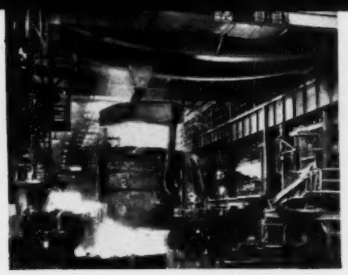
General Electric's "More Power to America" film library is a special series of programs designed to help you increase industrial and farm electrification, promote community improvement, and to stimulate your own public-relations activities. Each of these programs contains an educational motion picture or slidefilm, an authoritative manual, and supplementary literature. Specifically designed for use by the electric utilities, these packaged programs represent the best co-operative thinking of electrical and machinery manufacturers, application and consulting engineers. Non-commercial in nature, these film programs dramatically portray the latest electrical ideas and techniques in the use of electrical power in fields ranging from Materials Handling to Sewage Treatment.

The nation's leading utilities and other organizations are now using over 2000 "More Power to America" programs as vital components of their power sales and community development activities. Utilities of all sizes are placing increasing emphasis on MPA's creative, mass-selling methods. If you would like full details and prices of these film programs—or if you would first like a preview—contact your local G-E Apparatus Sales Office, or mail the coupon to General Electric Co., Schenectady 5, N. Y.

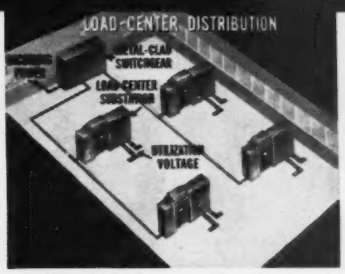
More Power to America



Resistance Welding



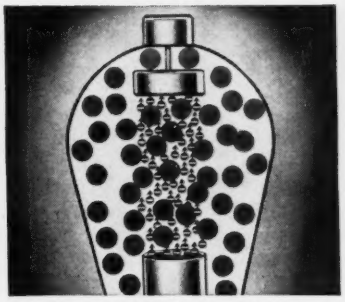
Materials Handling



Industrial Power Distribution

Laundry Electrification

Textiles

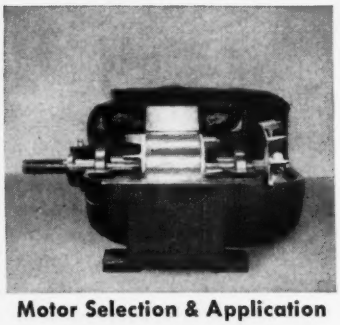


Electronic Training Course

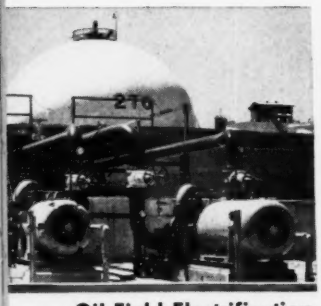
Electric Arc Welding

SEND IN COUPON BELOW

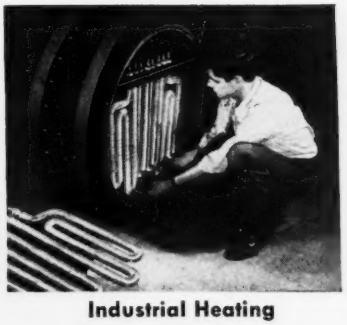
Progressive Mechanization



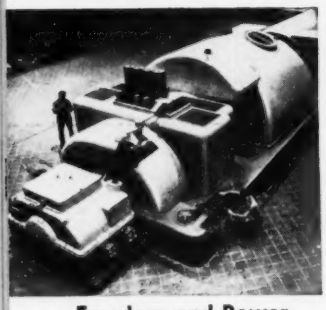
Motor Selection & Application



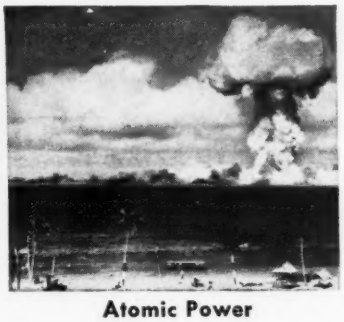
Oil Field Electrification



Industrial Heating



Freedom and Power



Atomic Power

GENERAL ELECTRIC COMPANY
APPARATUS SALES DIV., SEC. G684-3
SCHENECTADY 5, N. Y.

I am interested in the following film programs:

✓ **for details and prices** × **on a loan basis**

- ☐ Sewage Treatment (25-minute, 16-mm sound-color motion picture) (GEA-4938-5A)
- ☐ Outdoor Recreation (20-minute, 16-mm, sound, black-and-white motion picture) (GEA-4938-15)
- ☐ Water Supply (25-minute, 16-mm, sound-color motion picture) (GEA-4938-17)
- ☐ Urban Transit (17-minute, 16-mm, sound-color motion picture) (GEA-4938-20)
- ☐ Barn Hay Curing (28-minute, 16-mm, sound-color motion picture) (GEA-5074-1A)
- ☐ Farm Welding (25-minute, 16-mm, sound-color motion picture) (GEA-5074-2)
- ☐ Farm Water Supply (20-minute, 16-mm, sound-color motion picture) (GEA-5074-3)
- ☐ Electrified Farming (20-minute, 16-mm, sound-color motion picture) (GEA-5074-5)
- ☐ Laundry Electrification (30-minute, 35-mm, black-and-white sound slidefilm) GEA-4938-1A)
- ☐ Electronics Training Course (Twelve 20–30-minute, 35-mm, black-and-white sound slidefilm) (GEA-4938-3B)
- ☐ Resistance Welding (30-minute, 16-mm, sound-color motion picture) (GEA-4938-6A)
- ☐ Power Distribution (20-minute, 35-mm,sound-color slidefilm) (GEA-4938-8B)
- ☐ Oil Field Electrification (30-minute, 16-mm, sound-color motion picture (GEA-4938-9A)
- ☐ Materials Handling (24-minute, 16-mm, black-and-white sound motion picture) (GEA-4938-10A)
- ☐ Electric Arc Welding (27-minute, 16-mm, sound-color motion picture) (GEA-4938-11)
- ☐ Textiles (26-minute, 16-mm, sound-color motion picture) (GEA-4938-13)
- ☐ Industrial Heating (30-minute, 35-mm, black-and-white sound slidefilm) (GEA-4938-14)
- ☐ Motor Selection and Application (Ten 10–30-minute, 35-mm, black-and-white sound slidefilm) (GEA-4938-16A)
- ☐ Progressive Mechanization (27-minute, 16-mm, sound-color motion picture) (GEA-4938-18)
- ☐ Freedom and Power (29-minute, 16-mm, sound-color motion picture) (GEA-4938-19)
- ☐ Atomic Power (15-minute, 16-mm, sound-color motion picture) (GEA-4938-22)

NAME .....

TITLE .....

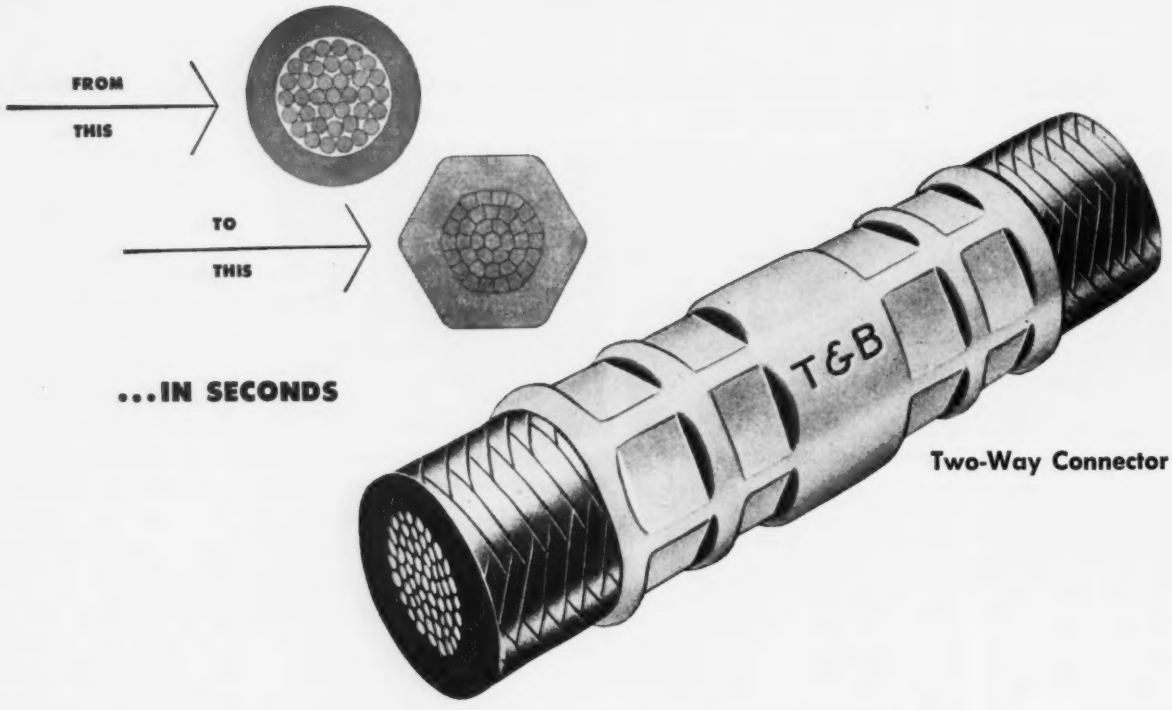
COMPANY .....

ADDRESS .....

CITY ..... STATE .....

GENERAL ELECTRIC

T & B METHOD



THE STRONGEST CONNECTION FOR ALUMINUM OR COPPER CABLE

T & B METHOD two-way connectors form exceptionally tight butt splices that develop tensile strengths far in excess of National Electric Code requirements. Uniform all-around compression of T & B METHOD two-way connectors assures maximum contact and minimum current loss. A slight taper at the compression end of the fitting helps prevent damage to strands due to flexing and vibration.

The hardened steel dies of a light-weight, portable T & B hydraulic tool compress around the joint with tremendous hexagonal pressures and force the fitting and cable into one homogeneous mass . . . all in a few seconds.

Though the use of an oxide-inhibiting agent is recommended for T & B METHOD *aluminum* connections, no joint compounds are needed to obtain maximum electrical efficiency. For *copper* connections, no special cable treatment is required. T & B METHOD fittings for aluminum have fine serrations inside the barrel which, during compression, penetrate the insulating film of aluminum oxide on the outside cable strands. At the same time, the oxide film on the inner cable strands is effectively abraded, thereby maintaining a dense, tight joint of high conductivity.

Investigate the complete line of T & B fittings for aluminum and copper cable – they offer you savings in time and installation costs. Write for your free copy of T & B Bulletin #67.

LOOK FOR THIS SIGN – T&B ENGINEERED

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T31

THE THOMAS & BETTS CO.

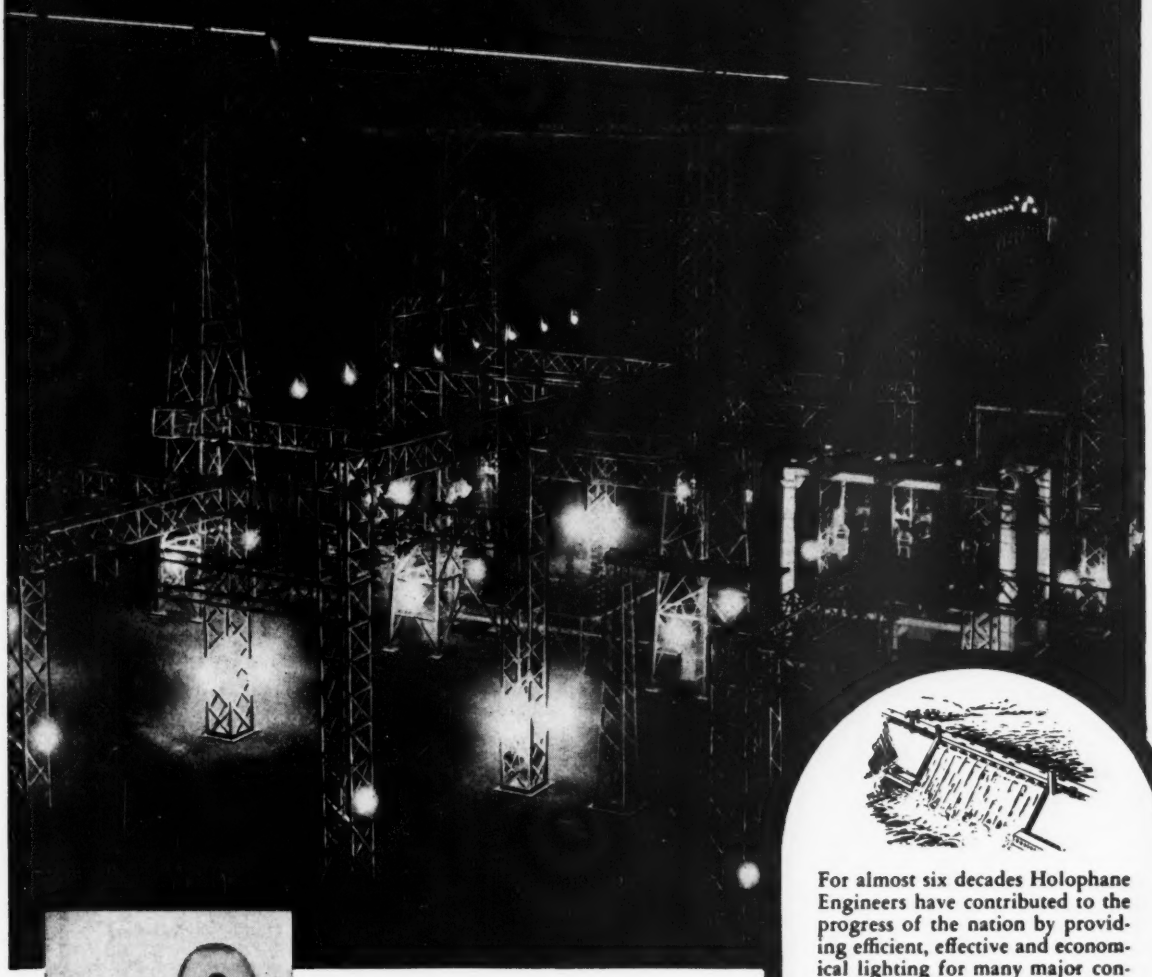
INCORPORATED

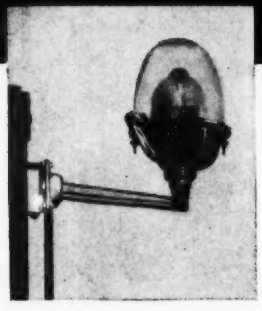
14 Butler Street • Elizabeth 1, New Jersey

Thomas & Betts Ltd., Montreal, P.Q., Canada

MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

HOLOPHANE LIGHTS *the Biggest Switchyard in the World*





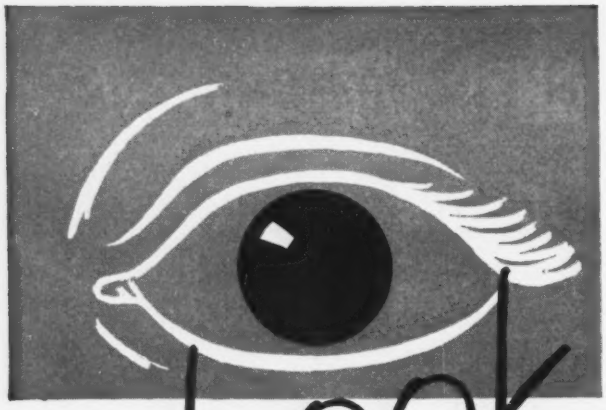
Typical Holophane substation unit (Nos. 043386-043776). Write for complete engineering and installation data.

For almost six decades Holophane Engineers have contributed to the progress of the nation by providing efficient, effective and economical lighting for many major construction projects . . . Shown is a view of Grand Coulee Dam, looking through the "Right Switchyard", regarded as one of the largest in the world. Here 299 Holophane substation lighting units are installed . . . Another indication of the steadfast acceptance of the basic principles for outdoor substation lighting as developed by Holophane . . . You are invited to consult Holophane Engineers on any lighting problem—without obligation, of course . . .

HOLOPHANE COMPANY, INC.

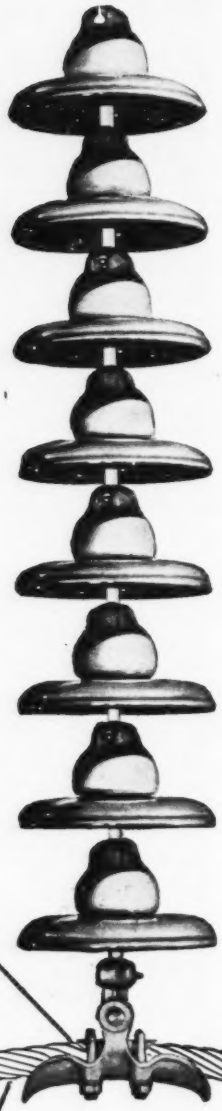
Lighting Authorities Since 1898 • 342 MADISON AVENUE, NEW YORK 17, N.Y.

THE HOLOPHANE COMPANY, LTD., THE QUEENSWAY, TORONTO 14, ONTARIO



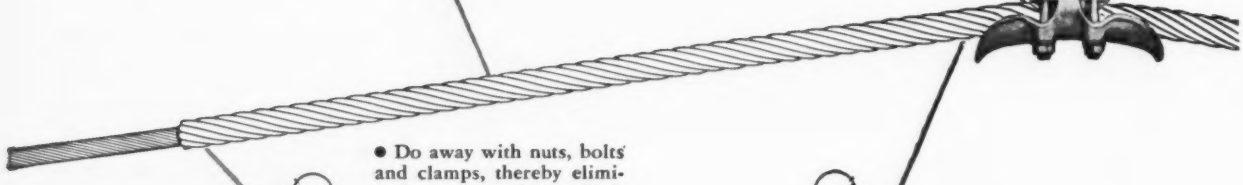
LOOK . . .

PREFORMED ARMOR RODS



• Maintain indefinitely their initial uniform, tight-fitting contact over the entire length of armor . . . assure uniform radial pressure throughout.

• Substantially reduce conductor stress at support points to minimize vibration fatigue.



• Do away with nuts, bolts and clamps, thereby eliminating any possibility of initial damage to conductor or subsequent loosening.

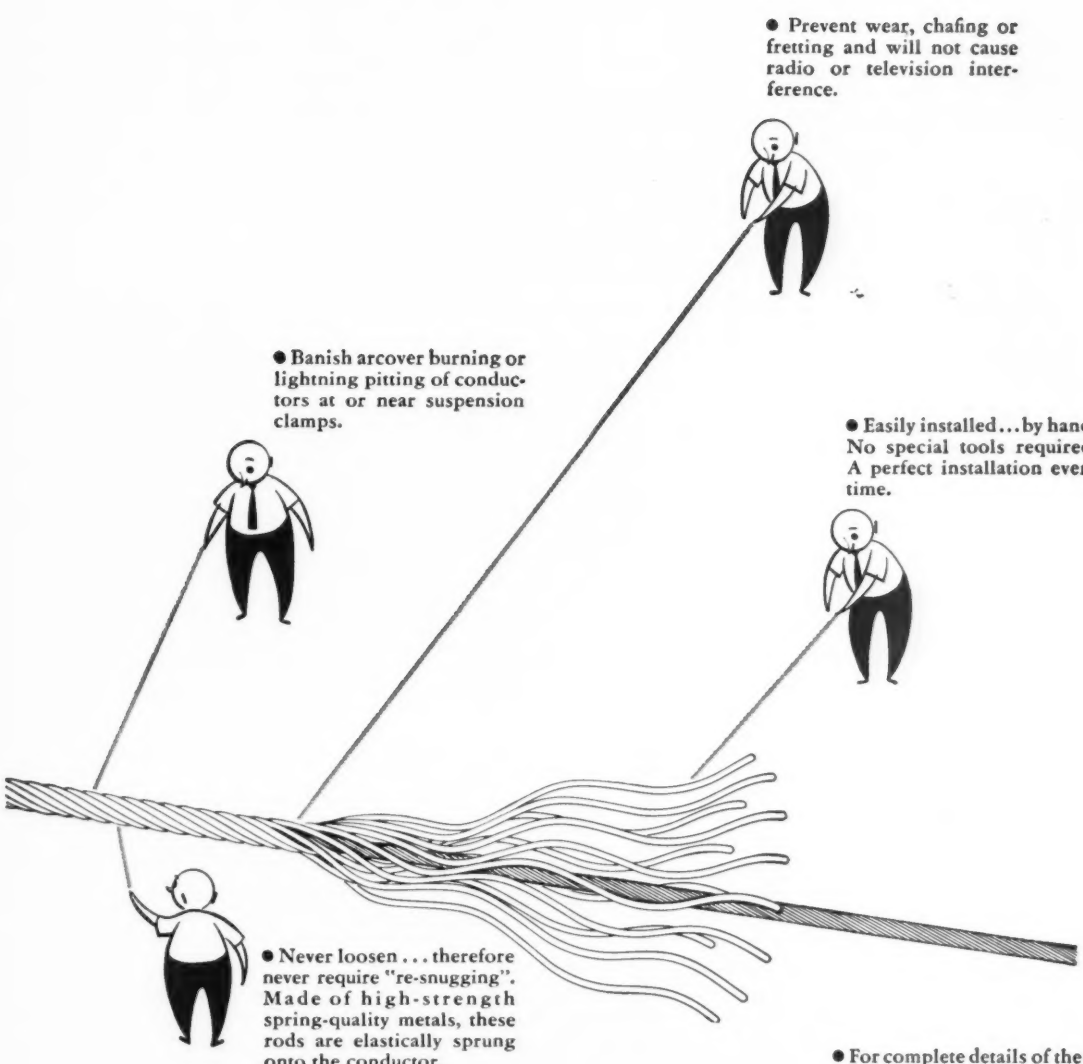
• Reduce operating temperature by providing a larger current path through the support.

**Preformed Armor Rods are manufactured under Patent No's 2,275,019 and 2,587,521 . . . other patents pending.*

PREFORMED LINE PRODUCTS COMPANY

5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO

TELEPHONE: CLEVELAND EXpress 1-3571



● Prevent wear, chafing or fretting and will not cause radio or television interference.

● Banish arcover burning or lightning pitting of conductors at or near suspension clamps.

● Easily installed... by hand. No special tools required. A perfect installation every time.

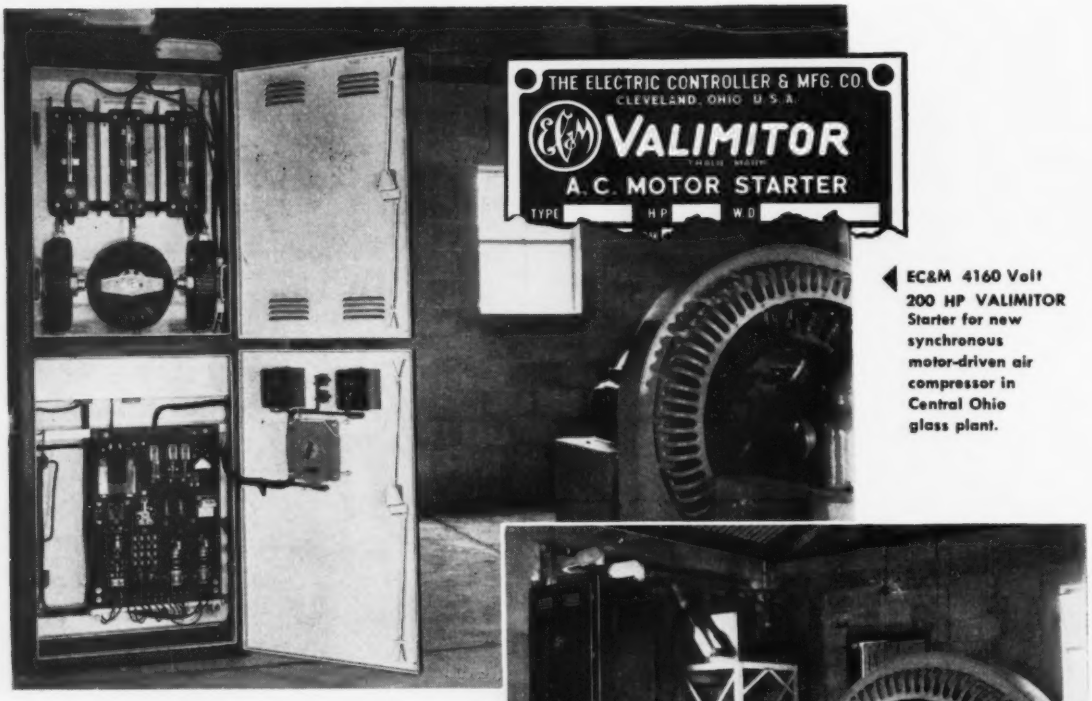
● Never loosen... therefore never require "re-snugging". Made of high-strength spring-quality metals, these rods are elastically sprung onto the conductor.

● For complete details of the exclusive advantages of Preformed Armor Rods, write or telephone Cleveland: EXpress 1-3571.

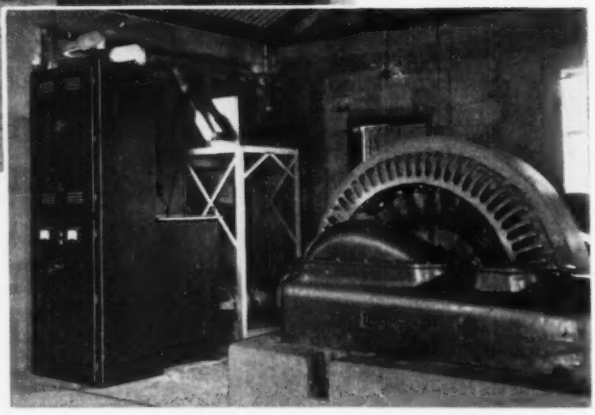
SALES REPRESENTATIVES

C. B. Anderson Co., *Tulsa* ● **Bergstrom-Verbarg Co.,** *Minneapolis* ● **Vincent J. Brown Co.,** *Buffalo* ● **Burns Electric Co.,** *Pittsburgh* ● **Earl S. Condon Co.,** *Los Angeles* ● **Cory and Crum,** *Indianapolis* ● **The Electrical Distributors Co.,** *Philadelphia* ● **Engineer Sales Co.,** *St. Petersburg* **JSG Electric Co.,** *Chicago* ● **E. L. Flowers,** *Boston* ● **George R. Horne & Co.,** *Dearborn* ● **Johnson Sales Co.,** *Bay City* ● **H. L. Macon & Co.,** *Atlanta,* **Peterson Co.,** *Denver* ● **Elgin B. Robertson, Inc.,** *Dallas* ● **Elgin B. Robertson Co.,** *Houston* ● **K. M. Ryals Co.,** *San Francisco* ● **Shaffer and Nelson,** *Portland, Seattle, Spokane* ● **M. H. Snyder & Sons,** *New York* ● **Curtis H. Stout,** *Little Rock, Memphis, New Orleans* ● **L. G. Wendegatz,** *Kansas City*

4-WAY PROTECTION for "essential" drives



◀ EC&M 4160 Volt 200 HP VALIMITOR Starter for new synchronous motor-driven air compressor in Central Ohio glass plant.



1 SHORT CIRCUIT Protection—KVA availability may be infinite—VALIMITOR (Volt-ampere-limitor) coils limit fault currents to 25,000 KVA. Type ZHS Contactor, with interrupting capacity of 50,000 KVA plus the d-c component, clears the circuit quickly.

2 MOTOR PROTECTED from overheating due to single phase operation or from overload when running. If motor pulls out of step and then re-accelerates the load, re-synchronization again occurs automatically.

3 UNDER VOLTAGE Protection—on momentary voltage dips, time-delay keeps push button circuit "active," eliminating necessity to re-press the start button if voltage recovers in two seconds or less. Contactor held in under full contact pressure down to 25% of normal voltage, then breaks cleanly. Avoids contact sticking under weak spring pressure.

4 PERSONNEL Protection—complete enclosure with hinged upper and lower doors on front cubicle. Upper compartment contains high voltage with electric door-interlock to open contactor circuit. Low voltage apparatus in lower compartment.

They couldn't afford a shut down. This essential "main-line" drive supplies air for the production of glass. Plant management found EC&M VALIMITOR Starters offered the best guarantee for continuity of service. No fuses to replace on a fault. The time-delay UVP feature was simple and the contactor held in down to a low voltage on a momentary voltage dip. The Type ZHS Contactor combined high interrupting capacity with ability to provide repetitive starts and stops with only routine inspection.

When making initial cost estimates, get the facts on EC&M High Voltage Starters. Our nearby office will be glad to supply full information on 2300-5000 volt starters which give complete protection.

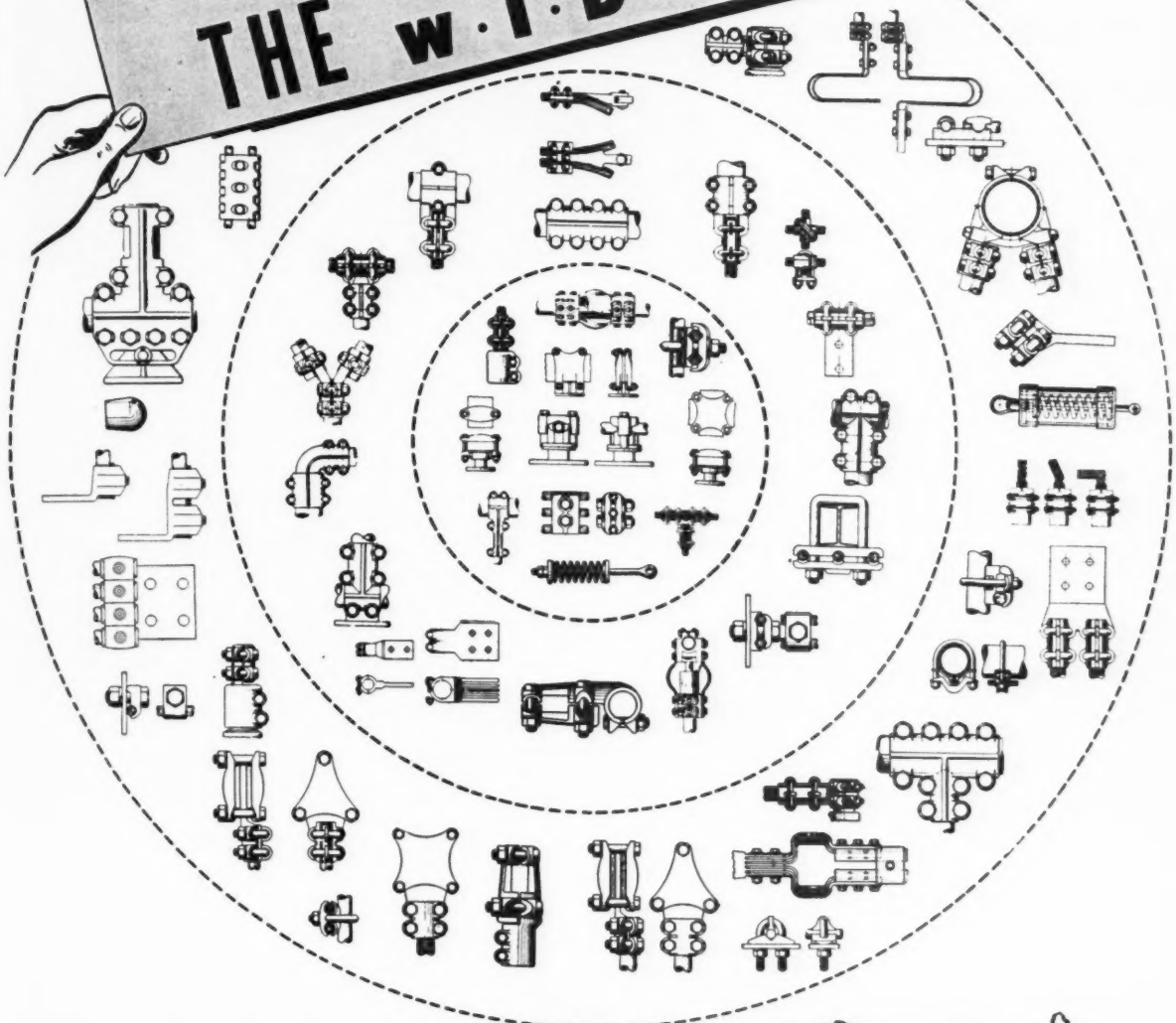
write for bulletins 1062 and T9-117

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET • CLEVELAND 4, OHIO

when you need . . . .

POWER CONNECTORS • GROUND CLAMPS AND EQUIPMENT TERMINALS *be sure to check*

Royal THE W·I·D·E LINE



Royal Power Connectors are manufactured from high-conductivity, high strength copper alloy. Multiplicity of point contacts develop the lowest resistance and highest pull-out strength. ½-inch Silicon Bronze hex head bolts are standard for conductor sizes from ½" IPS and larger, and 500 MCM and larger. Nested bolt heads permit "one wrench" installation. Let us quote on *your requirements.*

Royal

A Part of the Arsenal of AMERICAN POWER PRODUCTION

ROYAL ELECTRIC MANUFACTURING COMPANY

INCORPORATED

1122 EAST 87th STREET — *Chicago 19, Ill.*

Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices

COMING UP...1,733,200 hp

Excavation for "The Dalles" Dam and Powerhouse Starts as Baldwin-Lima-Hamilton Begins Manufacturing the World's Most Powerful Adjustable Blade Propeller Turbines

THE DAM AND POWERHOUSE at The Dalles begin to take shape as this huge earthmoving equipment goes to work.

Work is now under way in Baldwin-Lima-Hamilton Corporation's Eddystone (Pa.) plant on the first of the fourteen hydraulic turbines they are manufacturing for the Corps of Engineers, U. S. Army, project at "The Dalles." The most powerful adjustable blade propeller turbines in the world, each is rated 123,800 horsepower, 85.7 rpm under 81-ft head. Delivery of these turbines is scheduled to extend through July 1959.

Meanwhile construction of the dam and powerhouse is progressing at The Dalles, Oregon, which is located on the Columbia River between the Bonneville and McNary Dams. When completed in 1960, this project will fulfill a dual purpose. Aside from being a power development, it is also the Corps of Engineers' fourth stage of development of the Columbia River in the interest of navigation at The Dalles.

THE DALLES DAM—Ultimately the power house will contain 22 Hydraulic Turbines with a total rated capacity of 2,723,600 hp.

BALDWIN
BLH
LIMA-HAMILTON

BALDWIN-LIMA-HAMILTON

Philadelphia 42, Pa. • Offices in Principal Cities

NOW...

To Build Greater Desire for Electric Living...

Hotpoint Announces Its NEW 1954 Electric Range Line!

Electric living begins with the electric range As greater acceptance for electric cooking is developed, more and more modern revenue-building electric servants make their presence felt on utility lines. To provide greater satisfaction in, and desire for, electric cooking, Hotpoint offers these new features in its 1954 line:

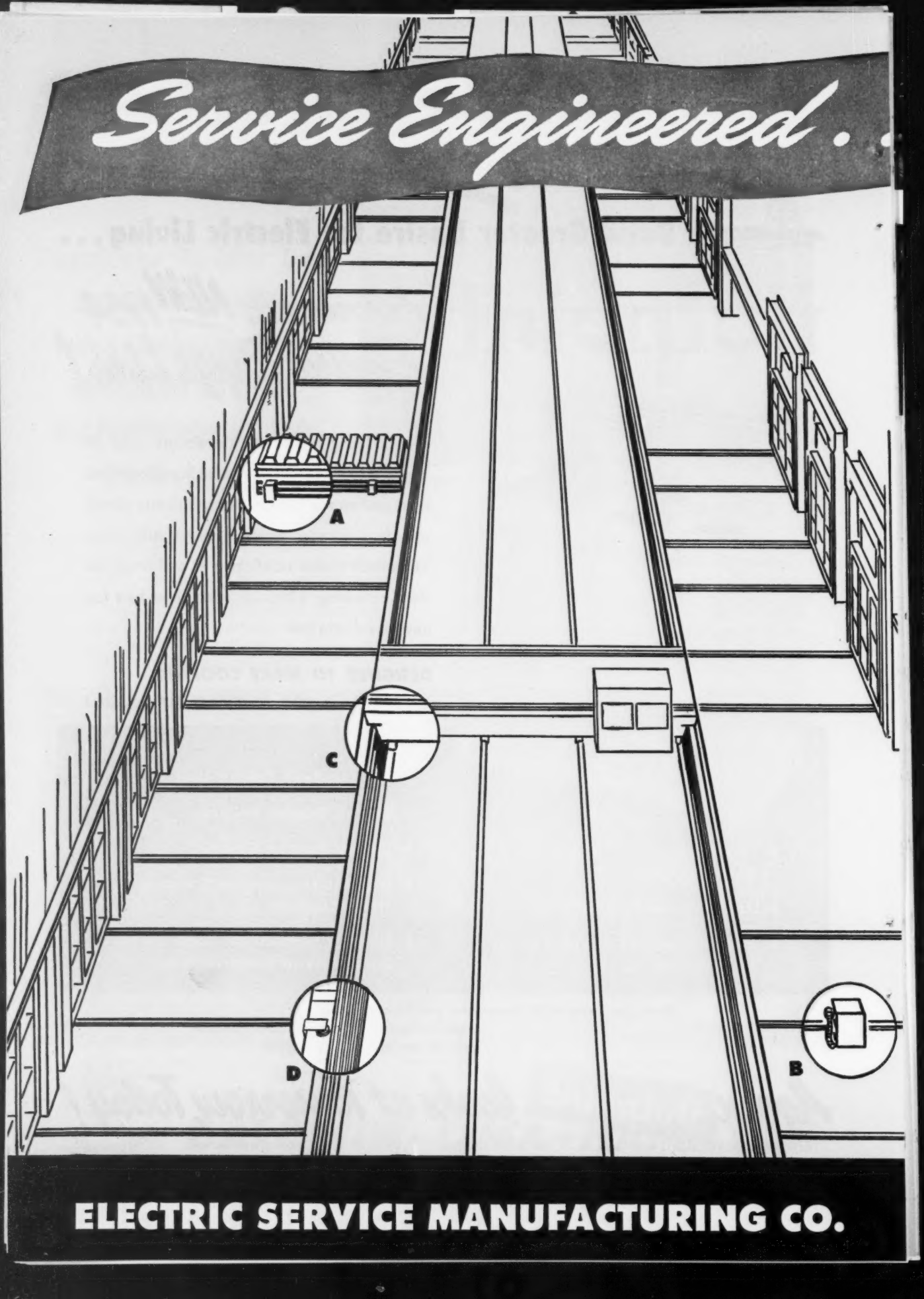
DESIGNED TO MAKE COOKING A JOY INSTEAD OF A JOB!

- The World's Most Efficient Domestic Oven
- Golden Bake Calrod® Unit
- Dial-a-Heat Control on Calrod Surface Unit
- Golden Broil Calrod Unit
- Calrod Golden Fryer
- Calrod Golden Griddle
- Handi-Lift Cover on Raisable Thrift Cooker
- Lighted Pushbutton Controls for Color-Keyed Surface Units

Have your Hotpoint distributor show you this outstanding new range line incorporating the industry's greatest array of new sales-making features.

Again, Hotpoint looks at Tomorrow, Today!

HOTPOINT Co. *(A Division of General Electric Company)* ***5600 West Taylor Street, Chicago 44, Illinois***


Service Engineered . . .
A
C
D
B
ELECTRIC SERVICE MANUFACTURING CO.

ELECTRIC SERVICE EQUIPMENT

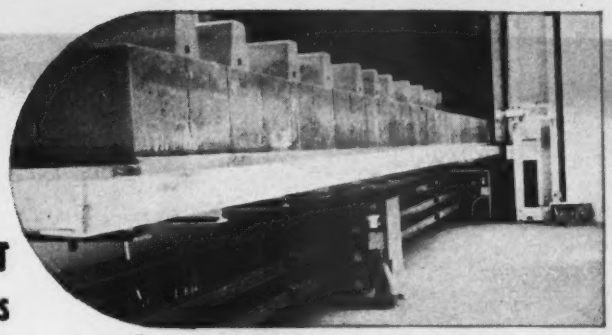
IS BUILT TO MEET RUGGED SERVICE DEMANDS

Rugged service is routine in this huge installation in the Armorcast Plant of the Birdsboro Steel Foundry and Machine Company. Electric Service collector and insulation equipment was specified throughout by Gilbert Associates, because it is "service-engineered" to provide continuous trouble-free performance under severe operating conditions.

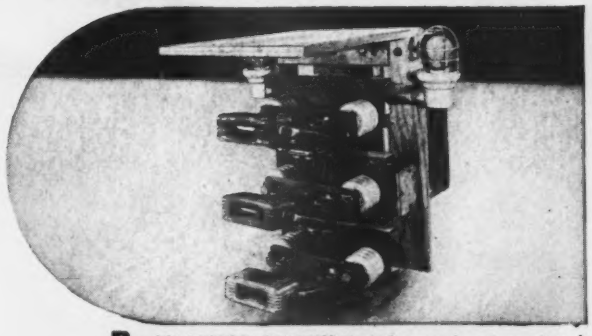
Here, in a battery of heat treating furnaces, heavy cumbersome tank hulls are conveyed on refractory-bed furnace cars. Rails fastened to the movable furnace cars are energized by the stationary Keystone Type LMI Collectors in the column.

All work movement is controlled through the pit transfer car. Individual furnace service lines are energized only when this pit transfer car is correctly aligned to pick up or deliver a furnace car at a particular furnace.

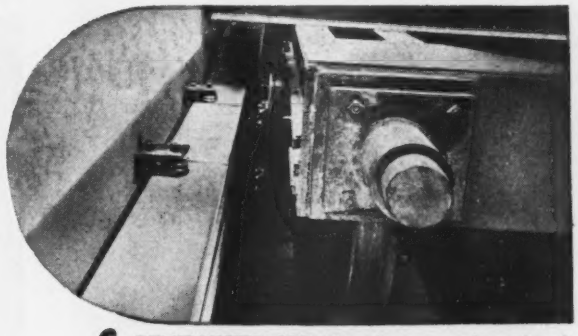
Whatever your plans, heavy-duty or ordinary industrial service, just call or write our service-engineering department. There is no obligation . . . their service is yours for better power transmission.



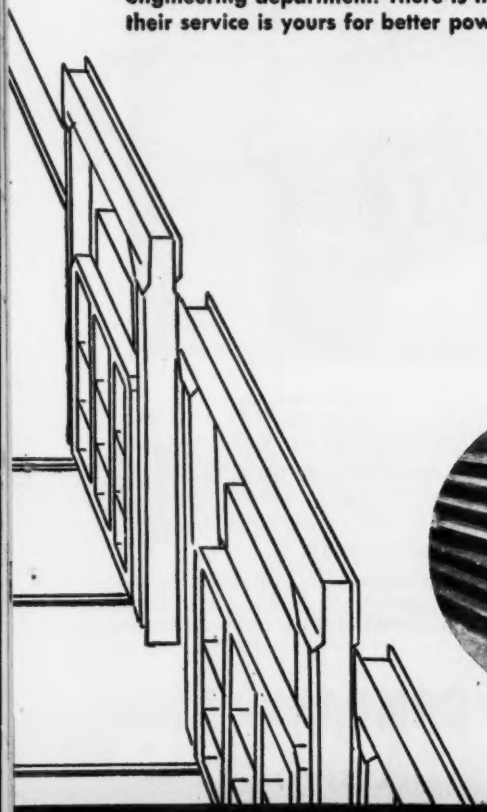
A FURNACE CAR Rail assembly is mounted on furnace car bed, using split porcelain Keystone Under-Contact Rail Insulators.

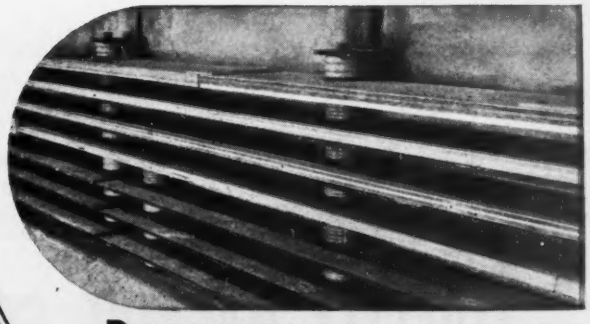


B COLLECTOR COLUMN Each furnace bay is equipped with three service columns. Collectors are Keystone Type LMI. Insulators are Keystone Glastic.



C PIT TRANSFER CAR This prime mover is equipped with the efficient, Type L Collectors on a seven rail contact assembly.





D PIT RAIL ASSEMBLY Flat rails and Keystone Glastic Insulators require minimum vertical space. Upper rails are plywood protected. Rails on opposite side energize furnace cars.

Write for detailed catalogs.

Philadelphia 32, Pa.

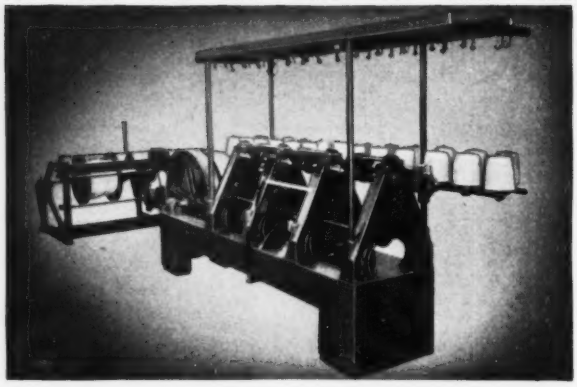
Represented in Canada by Lyman Tube and Bearings, Ltd., Montreal and Toronto

More and more, leading wire manufacturers the world over are proving the advantages of the *Fidelity Sinfra Knitter.**

With each new installation the *Sinfra* establishes —time after time—its ability to cover wire faster and more economically than any other method.

Today, the list of *Sinfra* users includes the world's foremost manufacturers of Wire and Cable.

Why not prove for yourself the outstanding advantages of this amazing machine? Write today for Catalog W-1 or visit the new show rooms at our plant.



*Approved by Underwriters' Laboratories, Inc., American Standards Association, Association of American Railroads, Canadian Standards Association, and Federal Specification J-C-145.

Designers and Builders of Intricate, Automatic Precision Machines

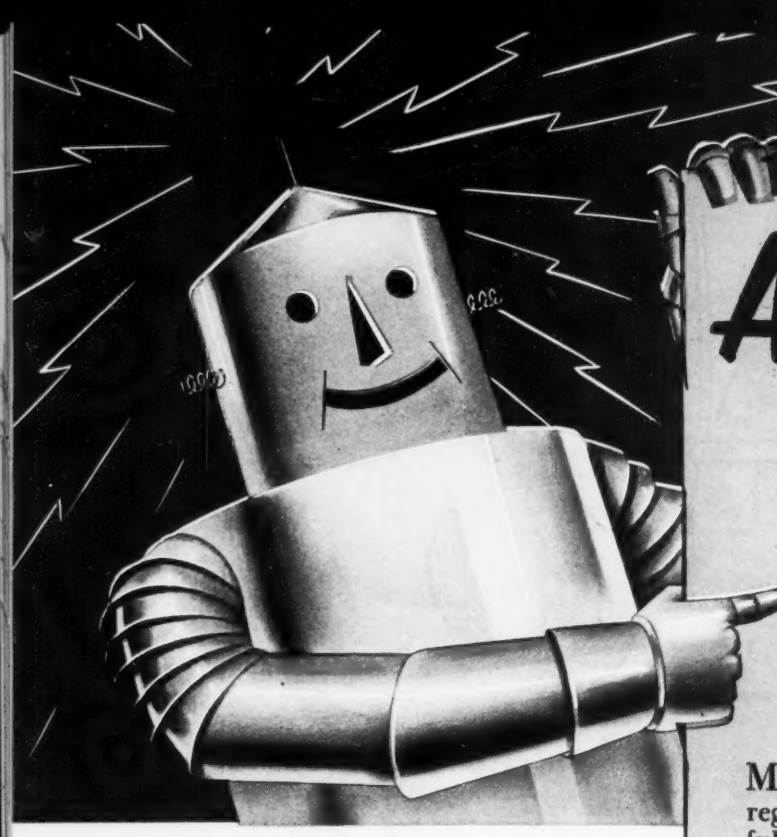
SINCE 1911

FIDELITY MACHINE COMPANY, INC.

3908-18 FRANKFORD AVENUE, PHILADELPHIA 24, PA.

Export Dept.:
25 Beaver Street, New York 4, N. Y.

Canadian Representative:
The Larson Co., Toronto, Ontario, Canada.



AUTOMATIC

Demineralization and Silica Removal by Ion Exchange Resins

MOTOR and diaphragm-operated valves make regeneration of Permutit Demineralizers fully automatic. This gives more positive control . . . eliminates the possibilities of costly errors . . . saves valuable man-hours formerly spent in regeneration.

In a recent installation for a 1450 psi boiler, two compact Permutit units fill all make-up requirements, regardless of changes in turbine loads . . . deliver a continuous supply of demineralized, silica-free water. What better way to eliminate scale and silica deposits!

HIGHEST PURITY MAKE-UP

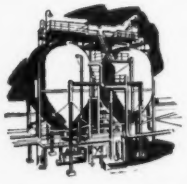
Effluents of Permutit Demineralizers have contained *total* electrolytes as low as 0.01 ppm and silica as low as 0.01 ppm! These values may be slightly higher under service conditions. In comparison, most distilled water contains 20 to 100 times more electrolytes . . . yet costs much more to produce.

INFORMATIVE NEW BULLETIN

You'll want this interesting book. Flow diagrams, illustrations and specifications explain key methods of demineralizing water and removing silica by ion exchange. Write for your copy, today!

THE PERMUTIT COMPANY, Dpt. EW-12, 330 West 42nd Street, New York 36, N. Y., or the Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal, P. Q.

OTHER BASIC WATER CONDITIONING PROCESSES



Sludge Blanket Hot Lime Soda

Full utilization of Permutit sludge-blanket principle assures high efficiency. Reduces hardness to region of 20 ppm . . . silica to 2.0 ppm. Lowers alkalinity . . . removes wide variety of solids.

Hot Zeolite—Permutit Q

Permutit Q—a styrene base resin resistant to high temperatures and pH values—replaces second stage phosphate treatment in hot-process softener. Results—residual hardness is completely removed at great savings in phosphate costs.

Deaerating Heater

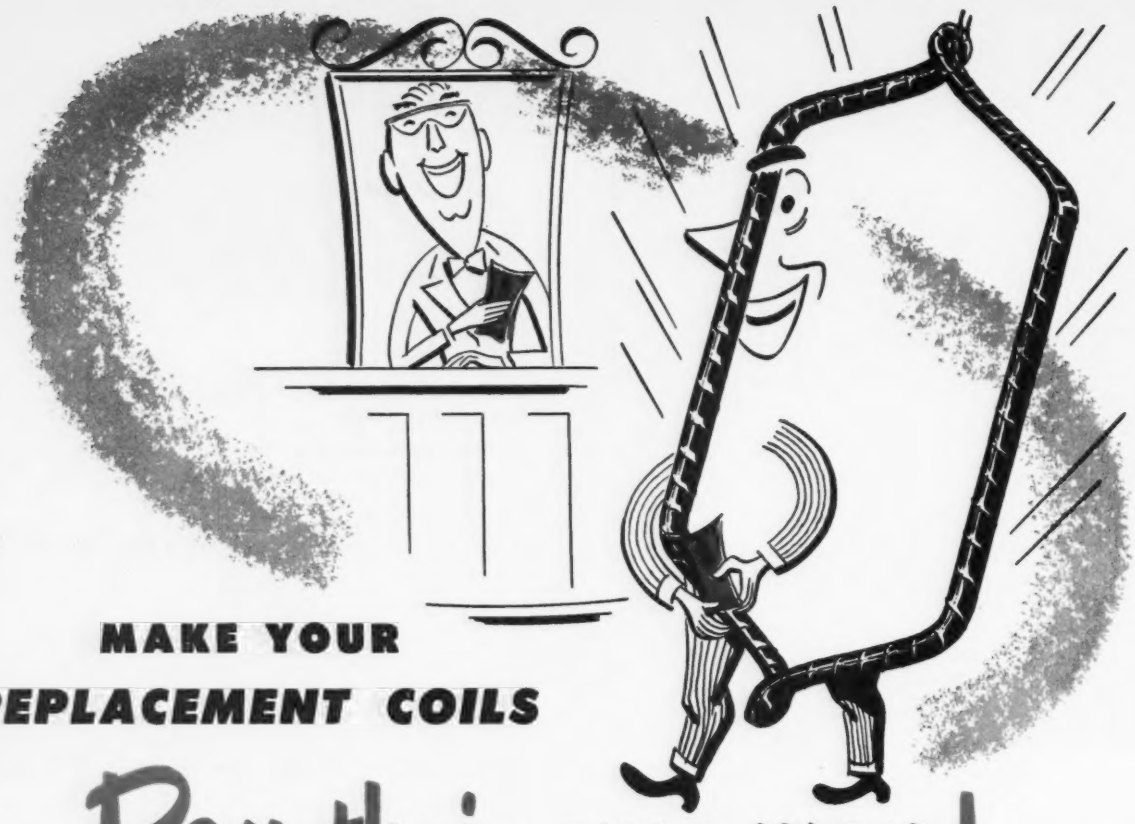
Removes objectionable oxygen and CO_2 to prevent corrosion and pitting of feed lines, stage heaters, economizers, and boilers at high temperatures. Steam is used twice . . . deaerates water completely.

Precipitator

Softens water on space and time-saving sludge-blanket principle. Simultaneously removes turbidity, color, fluorides, reduces silica and lowers alkalinity.

PERMUTIT®

ION EXCHANGE AND WATER CONDITIONING HEADQUARTERS FOR OVER 40 YEARS



MAKE YOUR REPLACEMENT COILS

Pay their own way!

An electro-metalurgical producer is drawing a large annual power bonus because National maximum-capacity design boosted the capacity of his generator by 15.9 per cent. Increased output will pay for the complete rewinding job in a little more than two years.*

"As good as new" is *not* good enough for National. A generator or motor with National replacement windings *must be better than new.* Every phase of National engineering and production is directed toward this objective.

Redesign for maximum capacity is typical of extras you can count on from National. Where increased output can be used or sold, National replacement windings will pay for themselves over a very short period of time. Where it cannot be utilized, extra capacity reduces operating temperatures and results in substantially longer coil life.

If you operate heavy rotating electrical equipment for any purpose, you can operate it more profitably with National windings. Get in touch with your nearby National field engineer today. Find out how National maximum-capacity design and National extra-quality coils can help your motors and generators do a better job.

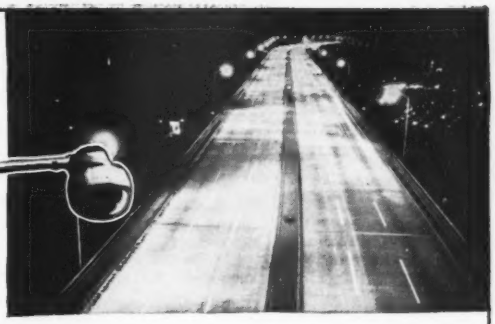
*Complete details on this installation available on request.

NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

TRADE MARK

ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION—
REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES



FATHER WASHINGTON BRIDGE

Night becomes day with super-modern lighting. P & K All-Aluminum standards are mounted on steelwork and have 30 foot mounting heights with 6-foot tapered elliptical arms.

the P&K *story on the New Jersey Turnpike*

The New Jersey Turnpike is a twentieth century miracle of highway design, engineering and construction. Here is one hundred eighteen miles of continuous road ... without a single traffic light or crossroad!

Within one year after its lanes opened, the "Pike" carried the amount of traffic predicted for the year 1968 ... and its safety record is better than parallel public highways in the state as well as most public roads in the nation.

This great national artery employs every known improvement and device to provide maximum safety for its users ... and its facilities are being expanded to meet increased traffic demand.

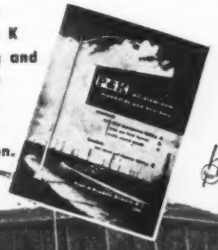
Lighting, modern and efficient, turns night into day on the New Jersey Turnpike ... and Pfaff & Kendall is proud to have been chosen as the original supplier of all highway and area lighting facilities throughout the entire 118 mile length of the highway. P & K All-Aluminum Standards and Arms have been specified and thus far have been the only type installed.

P & K ALL-ALUMINUM Standards and Brackets are Produced in Design and Types to Meet any Street, Road or Highway Requirement. They are Always the Wisest Investment ...

- .... much lighter weight *for lowest installation costs*
- .... negligible rate of corrosion *for longest life*
- .... no painting *for initial and lifelong savings*
- .... easily salvaged and re-used *in event of knock-down*

WRITE FOR LATEST P & K CATALOG

and use the P & K Planning and Advisory Services without obligation.



THE NEW JERSEY TURNPIKE

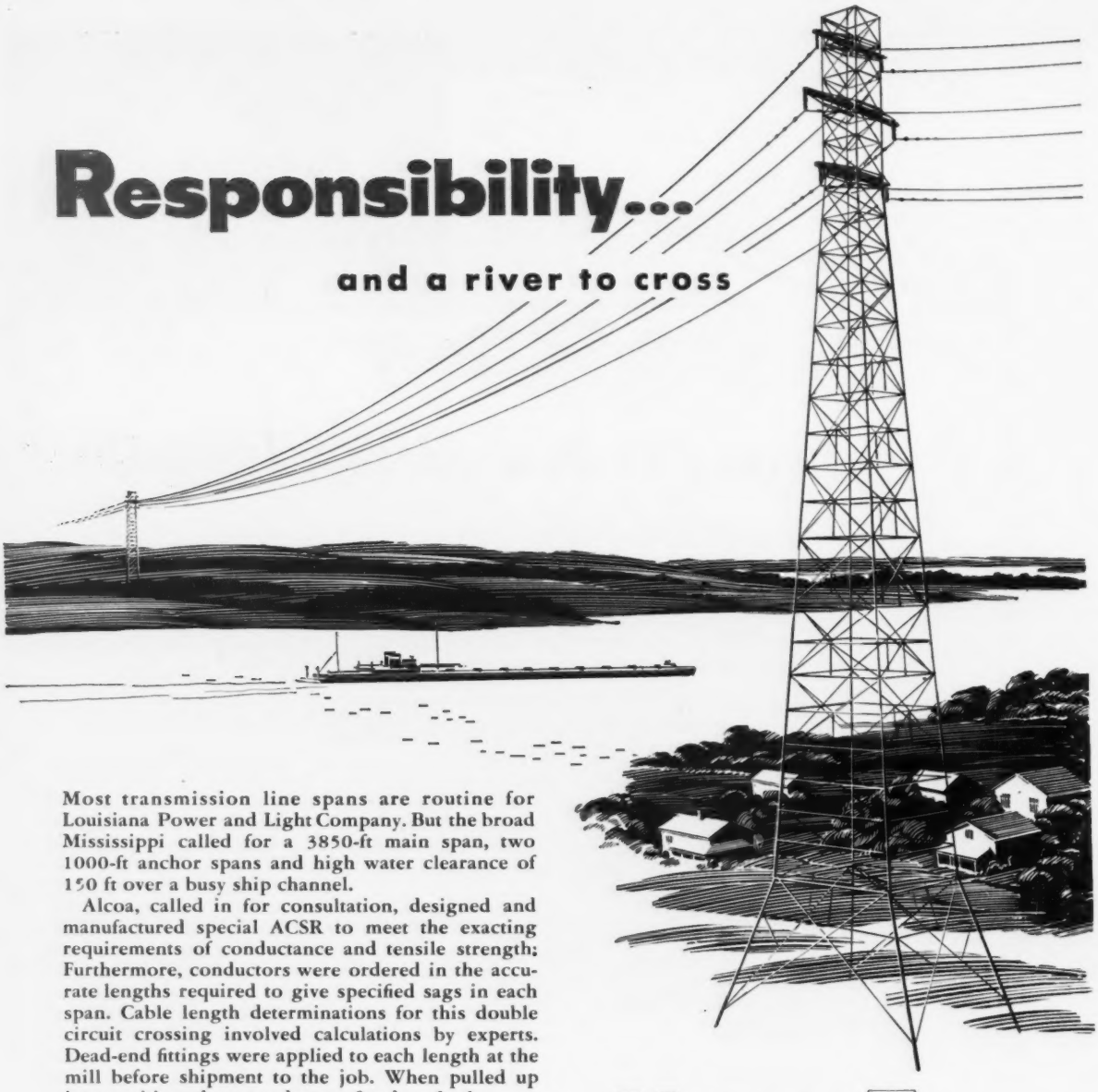
looking toward Laurel Hill and the Lewandowski Bridge crossing the Hackensack River. The P & K All-Aluminum Standards have 30 foot mounting heights, with 15 foot All-Aluminum Tapered Elliptical Arms, and Transformer Bases.

Pfaff & Kendall

84 Foundry Street
Newark 5, New Jersey

Responsibility...

and a river to cross



Most transmission line spans are routine for Louisiana Power and Light Company. But the broad Mississippi called for a 3850-ft main span, two 1000-ft anchor spans and high water clearance of 150 ft over a busy ship channel.

Alcoa, called in for consultation, designed and manufactured special ACSR to meet the exacting requirements of conductance and tensile strength; Furthermore, conductors were ordered in the accurate lengths required to give specified sags in each span. Cable length determinations for this double circuit crossing involved calculations by experts. Dead-end fittings were applied to each length at the mill before shipment to the job. When pulled up into position, these conductors fitted perfectly.

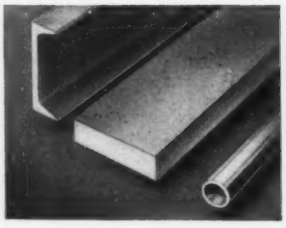
Unusual service? Not for Alcoa. We co-operate readily because we believe that the best installations are just as important as the best products. This is your guarantee of satisfaction with Alcoa® Aluminum Electrical Conductors. Aluminum Company of America, 2100-M Alcoa Building, Pittsburgh 19, Pa.

Alcoa Aluminum

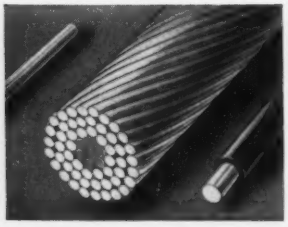
ALUMINUM COMPANY OF AMERICA

Alcoa brings the world to your armchair with "SEE IT NOW" featuring Edward R. Murrow, Tuesday evenings on most CBS-TV stations.

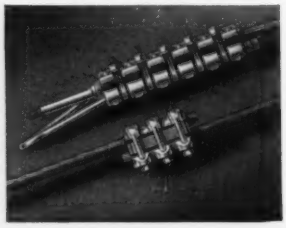
Alcoa Aluminum Bus is available in rectangular and solid round bars, channels and tubular shapes.



Alcoa Aluminum Electrical Conductors include ACSR, solid and stranded aluminum wire, bare or covered.



Alcoa's full line of aluminum accessories is correctly designed for use with all aluminum conductors.



Ripley leads the way...

with the FAMOUS SUNSWITCH Light Control

"double-duty 60"
SUNSWITCH
PHOTOELECTRIC CONTROL

Since 1936, when Ripley pioneered in developing the first photoelectric street-lighting control, the Ripley Company has continued its efforts to produce the finest control possible. And, now — available for the first time . . . a 60 ampere Lighting Control — the finest obtainable — the SUNSWITCH "double-duty 60".

Low first cost, simple installation and minimum maintenance make Ripley SUNSWITCH the ideal solution to your control problem for multiple street-lighting circuits.

These are sound reasons why it is always good business to call in Ripley when street-lighting controls are under consideration.

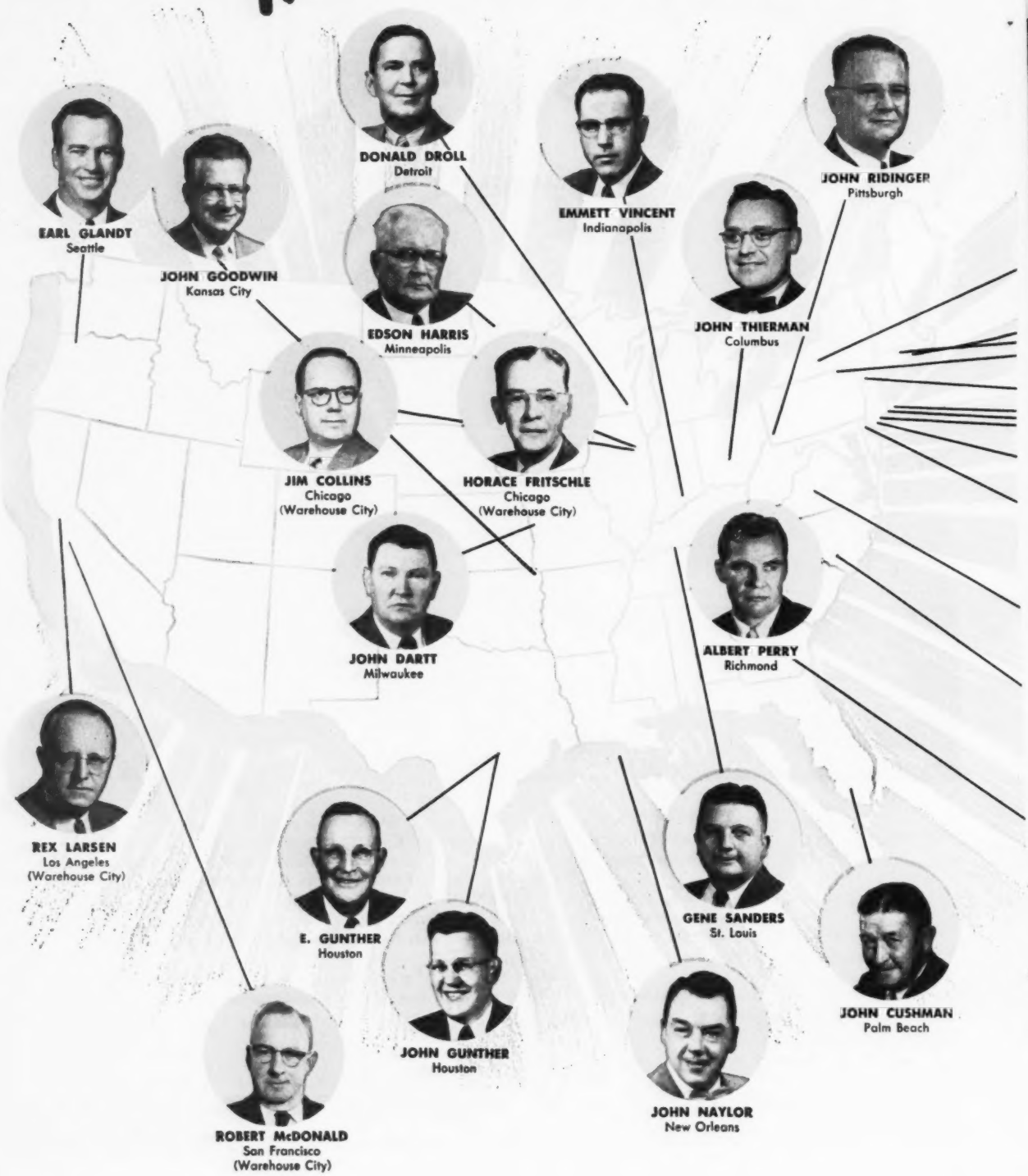
For the complete story with engineering data, write for Bulletin S-60

RIPLEY ESTABLISHED 1936

Superior . . . . . through Research

THE RIPLEY COMPANY, INC., MIDDLETOWN, CONN.

THESE 31 *Triangle* REPRESENTATIVES



ALL HAVE THE SAME MIDDLE NAME-

Service

EDWARD COOK, JR.
Buffalo

P. BANGHART
Boston
(Warehouse City)

EDWARD COOK, SR.
Albany

JAMES SLATER
Boston
(Warehouse City)

H. FLIEHMAN
New York City

ROBERT DUCKWITZ
Philadelphia

JAMES SWAN
Babylon

BRUCE JOHNSON
New Brunswick

AL WALKER
New Brunswick

EUGENE CROSS
Philadelphia

PAUL KIDDER
Baltimore

JOHN CUSHMAN, JR.
Charlotte
(Warehouse City)

MICHAEL WELCH
Atlanta

These Triangle Sales Representatives have a responsibility to you. They all are dedicated to one aim—to serve you better, quicker and in a more friendly way than you ever thought possible. Cooperation, sincerity and honesty come first on their list of "musts."

These men are backed by a manufacturing organization that has grown, since 1916, from a one story building to an imposing array of four large factories. Starting as a manufacturer of Armored Cable and Flexible Steel Conduit, Triangle today is one of the foremost manufacturers of electrical wire, cable and conduit. In addition to the electrical field, Triangle is now producing plastic pipe, brass and copper tube for the plumbing and heating industry, plus numerous other applications. We at Triangle believe the contributing factors to this growth have been the extra quality of our service and products along with our 100% distributor policy. Service, coupled with our directive to our employees that our products *must be right*, have been the keystones of our business policies.

If you distribute, buy, specify or install wire, cable, conduit, plastic pipe or brass and copper tube, it will pay you to ask for TRIANGLE.

TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, NEW JERSEY

Manufacturers of arteries for **electricity, liquids and gases.**

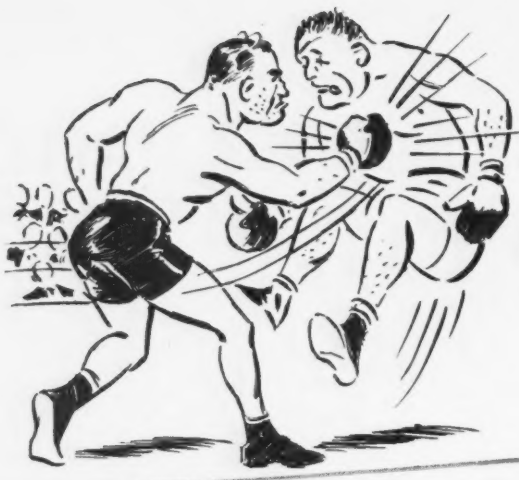
Wire · Cable · Conduit · Plastic Pipe · Brass and Copper Tube

PLANTS—NEW BRUNSWICK, N. J.:
Wire and Cable Plant · Rod Mill · Brass and Copper Tube Mill · Plastic Pipe Plant

MOUNDSVILLE, W. VA.: Conduit Plant

TRIANGLE

It Must Be Right



THIS OIL PURIFIER IS A "ONE-PUNCH" CHAMPION!

ADVANTAGE OF DE LAVAL PORTABLE OUTFIT	WHAT THIS MEANS TO THE POWER ENGINEER
✓ A De Laval Portable Outfit dehydrates at a single pass.	✓ No re-running is necessary, saving time and money.

Constant high purifying efficiency–no shutdowns for cleaning or for renewal of parts during run ✓

Dehydrates at a single pass–no re-running

Higher daily capacity of insulating oil saves maintenance costs ✓

Heater cannot carbonize the insulating oil

Safest–continuous discharge of water prevents re-contamination of the insulating oil ✓

Centrifugal purifier is economical to operate

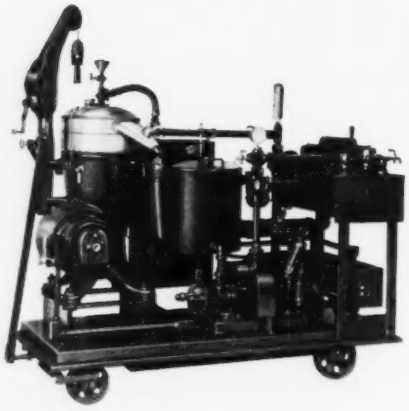
Removes free water without aid of filter press; press used only to remove colloidal carbon ✓

Low temperature purification; high dielectric value of oil maintained longer

De Laval Insulating Oil Purifiers by means of properly applied centrifugal force, purify and dehydrate transformer and circuit breaker oil completely at a single pass. They enable insulating oil to be maintained at lowest cost and highest efficiency.

When insulating oil is purified at a single pass, there is a greater daily output of thoroughly dehydrated oil, operating costs are lower, and the oil can be restored to a high dielectric value more economically.

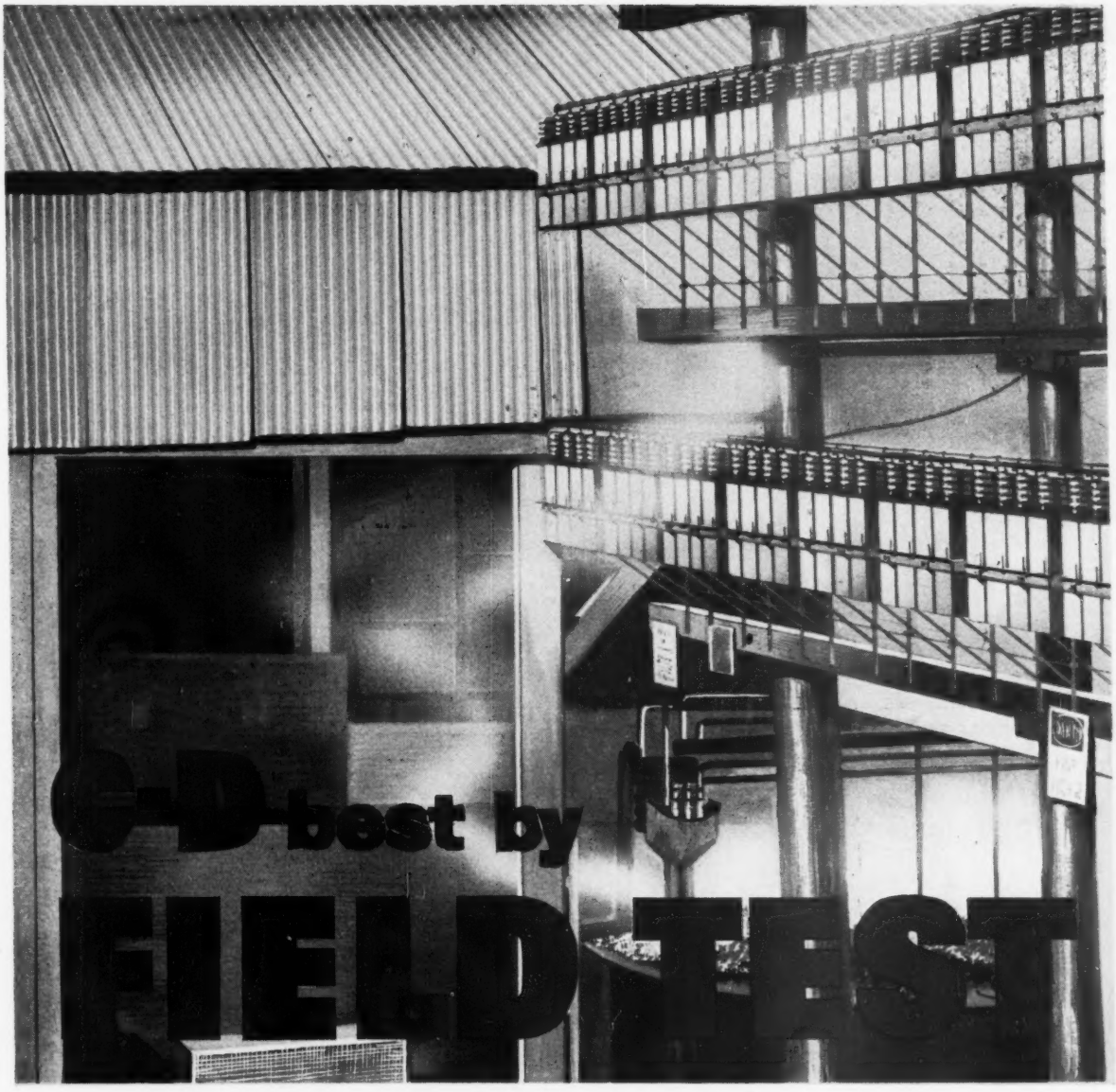
Centrifugal force ***alone*** reduces the water content; the filter press is used solely to remove colloidal carbon from circuit breaker oil.

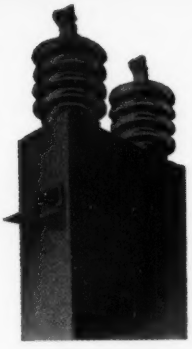


✓ CHECK THESE DE LAVAL SUPERIORITIES

THE DE LAVAL SEPARATOR COMPANY
Chicago POUGHKEEPSIE, N.Y. San Francisco

DE LAVAL INSULATING OIL PURIFIERS





This southeastern C-D capacitor installation is situated at the entrance to a large metallurgical smelter. Furnace temperatures run well over 3,000°F and the fumes are acidic. As a result these C-D capacitors are exposed to excessive temperatures and acid fumes that create a conducting electrolytic path leading to leakage and lower arc resistance of major bushing insulation. Yet, these C-D capacitors have given trouble-free service year after year, with little or no maintenance! It's another example of how C-D's superior engineering design that builds an extra margin of safety into each and every capacitor, pays off in the field year after year.

A C-D engineer can save you important maintenance dollars on your next power-factor installation. It will pay you to talk over your power-factor problems with him. No obligation, of course.

Cornell-Dubilier Electric Corporation, Dept. D-123, South Plainfield, N. J.

There are more C-D capacitors in use today than any other make

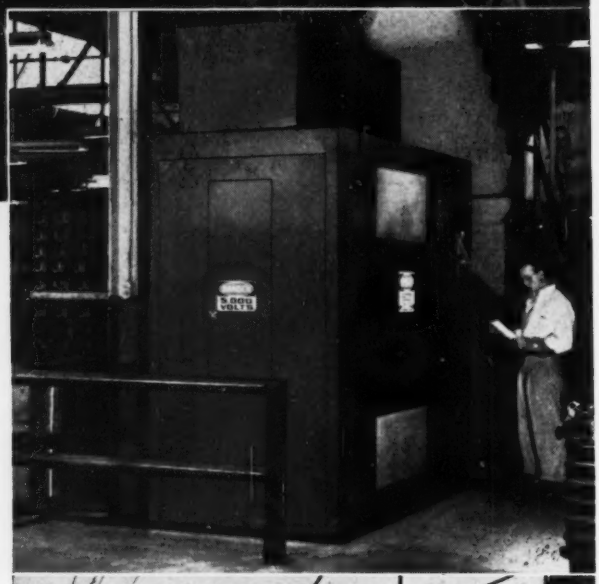
CONSISTENTLY DEPENDABLE

CORNELL-DUBILIER CAPACITORS

FOR POWER-FACTOR IMPROVEMENT

PLANTS IN SOUTH PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER AND CAMBRIDGE, MASS.; PROVIDENCE AND HOPE VALLEY, R. I.; INDIANAPOLIS, IND.; SANFORD AND FUQUAY SPRINGS, N. C.; SUBSIDIARY: THE RADIART CORPORATION, CLEVELAND, O.

POWER...



Above—one of the two 2,000 KVA unit sub-stations powered by an Uptegraff Dry Type Transformer, located near the assembly line.

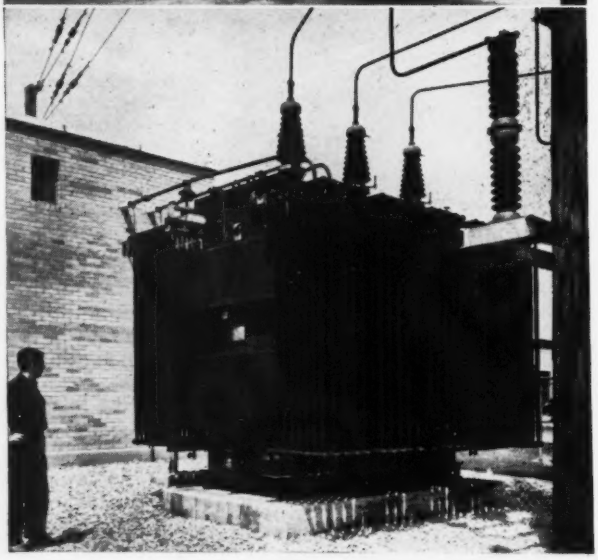
where and as needed . . .

with

UPTEGRAFF

transformers

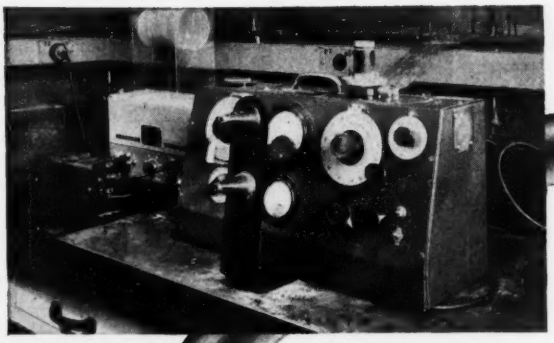
Located close to the center of their electrical loads, the Uptegraff Dry Type Transformers shown here serve efficiently in the Newark, Ohio plant of the Ohio Gear and Axle Division of Timken-Detroit Axle Company. Line losses are reduced by the central location of the transformers, and power characteristics are improved. In this plant are two 2000 KVA and two 1000 KVA dry type Uptegraff Transformers. Supplying these indoor dry type Uptegraff transformers is a 6000 KVA oil-cooled Outdoor Power Transformer.



R. E. Uptegraff Manufacturing Co.

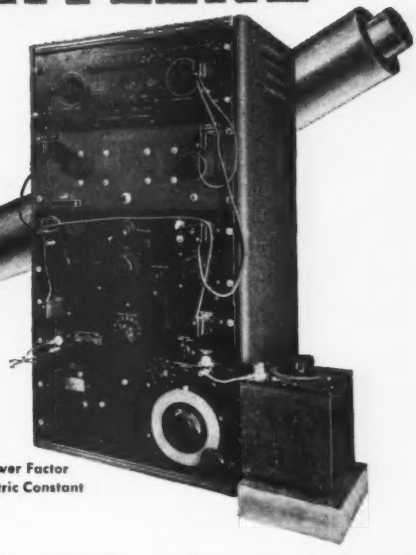
Scottdale, Pennsylvania

6000 KVA Uptegraff Outdoor Power Transformer supplying the entire plant is shown at the right.



Testing Insulation Resistance

Compare the electrical properties of BAKELITE POLYETHYLENE TRADE-MARK with other wire covering



Testing Power Factor and Dielectric Constant

Continuous laboratory testing proves that BAKELITE Polyethylene has superior electrical properties for signal and service drop cable.

For instance, its insulation resistance between 15½ deg. C. and 105 deg. C. is tested on the apparatus on the right. The insulation resistance is too high to measure on conventional testing devices. The apparatus above tests power factor and dielectric constant from 1000 cycles to 50 megacycles at room temperature. At 50 megacycles and 25 deg. C., the power factor of black BAKELITE Polyethylene is only 0.004, dielectric constant only 2.5. These values hold through the range from 60 cycles to 5 x 10^7 cycles. Operating temperatures up to 90 deg. C. have little effect on the electrical properties of BAKELITE Polyethylene. It excels in resistance to voltage breakdown, even after long-continued water-immersion.

BAKELITE Polyethylene possesses outstanding durability. It resists chemicals, water immersion, and abrasion. Extruded on wire, it won't festoon. Ten years' outdoor weathering data and accelerated laboratory aging of black polyethylene compound indicate a long service life.

For line wire use, it meets ASA suggested specifications (second draft: July 20, 1952) for weather-resistant wire and cable. It stays flexible down to –70 deg. C., resists deformation up to 90 deg. C. With a specific gravity of only 0.94, BAKELITE Polyethylene weighs less than any other line wire covering. In addition, it can be used as a thinner covering—normally 1/64 in. less wall thickness—because of its superior physical and electrical properties. As a result, it can be hung over longer spans, and is easier to handle, making stripping and splicing faster. Its smooth waxlike finish speeds pulling over crossarms.

Compare BAKELITE Polyethylene with other wire coverings. Detailed information is available in Kabelitems #48. For your free copy, write Dept. QT-63.

BAKELITE TRADE-MARK

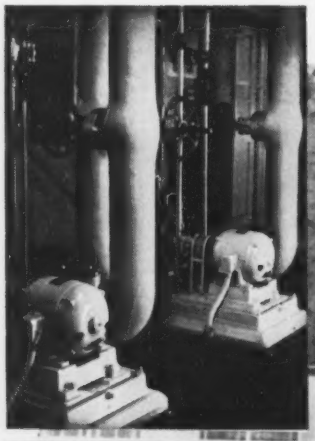
POLYETHYLENE

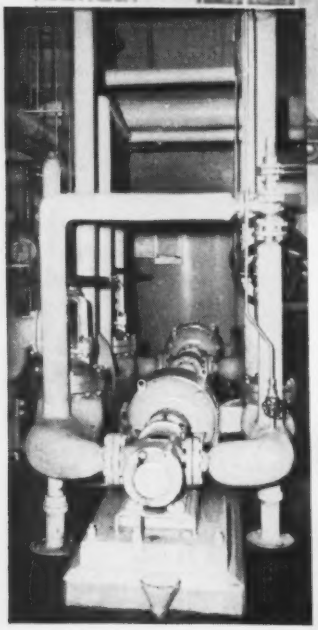
WIRE COVERING

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N.Y.

In Canada: Bakelite Company (Canada) Ltd., Belleville, Ontario

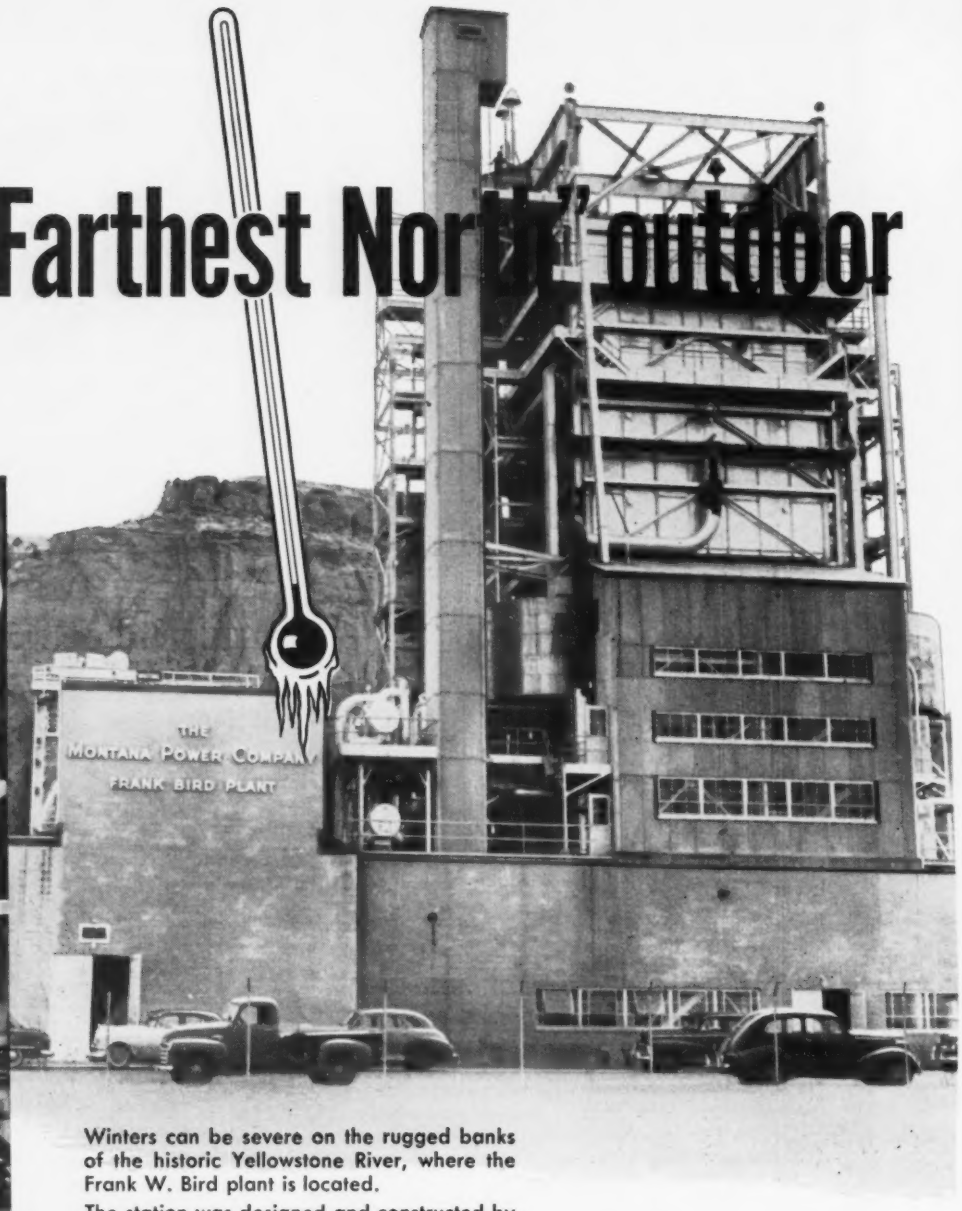
In this "Farthest North" outdoor





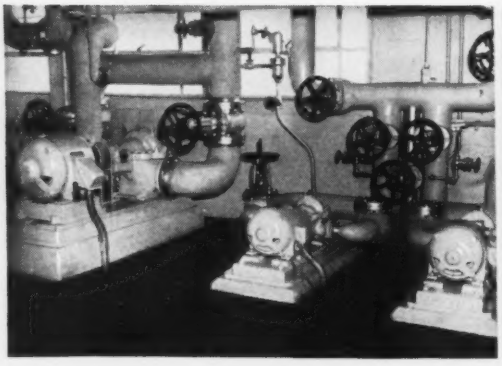
Some of the many Elliott C-W motors on pumps for oil burners, fuel oil transfer, condensate transfer, etc., as well as a number of other auxiliaries.

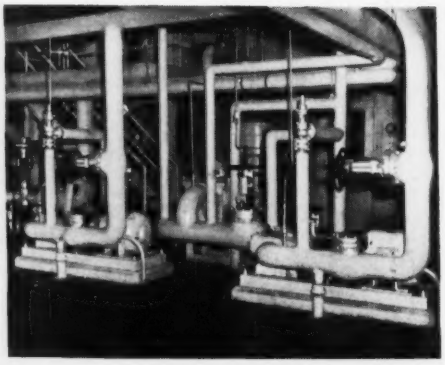
Q3-6



Winters can be severe on the rugged banks of the historic Yellowstone River, where the Frank W. Bird plant is located.

The station was designed and constructed by Ebasco Services, Incorporated.



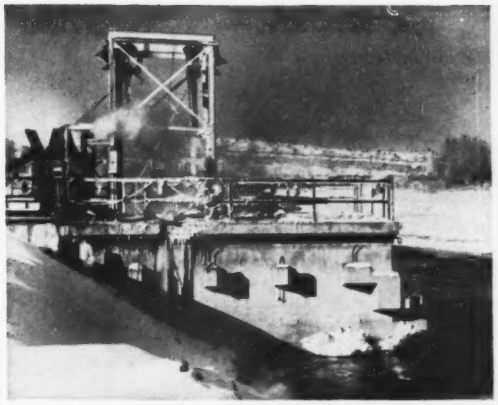


type station...

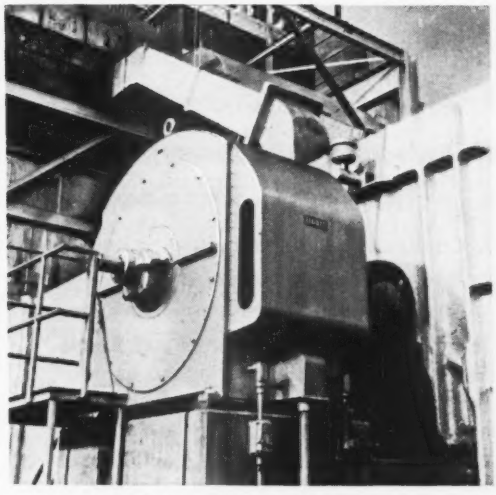
ELLIOTT MOTORS

FORTY BELOW is not an uncommon winter temperature at the Frank W. Bird Steam-electric Station of the Montana Power Company, near Billings. Blizzard conditions too, naturally. Pretty tough sleddin' for exposed equipment, but not too tough for the Elliott 1000-hp motor driving the induced draft fan in the picture at the right. This is the increasingly popular outdoor splashproof (weather-protected) design that needs no ducts nor cored foundation. A similar motor of vertical type, 500-hp, drives a circulating water pump located on the exposed river bank. Other large Elliott motors serve the plant in less exposed locations, as well as a number of Elliott Crocker-Wheeler motors of open dripproof type on auxiliaries — quiet, capable performers, all doing their share in holding station costs down.

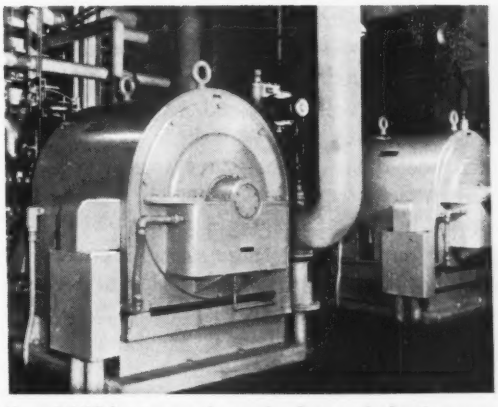
Your local Elliott representative or district office will give you complete data on the Elliott motors mentioned, or any other types you may need. Or write Elliott Company, Jeannette, Pa.



Out on the open river bank, buffeted by bitter winds, snow, sleet, etc., this Elliott 500-hp 12-pole vertical outdoor splashproof (weather-protected) motor drives a circulating water pump.



This Elliott 1000-hp outdoor splashproof (weather-protected) motor drives an induced-draft fan.



Two 1250-hp two-pole squirrel-cage induction motors on boiler-feed pump service.

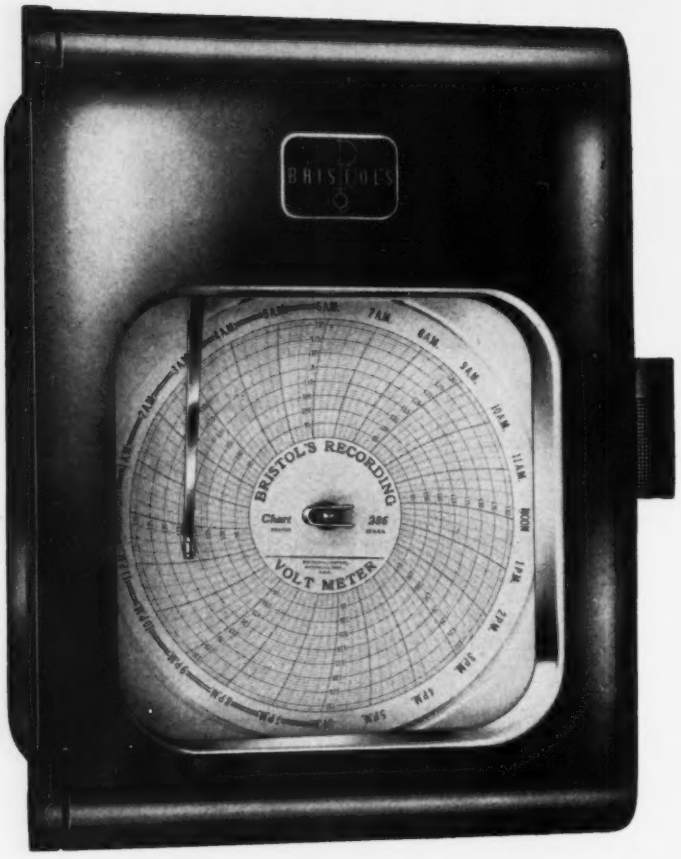
ELLIOTT Company

STEAM TURBINES • MOTORS • GENERATORS • DEAERATING HEATERS • EJECTORS • CONDENSERS • CENTRIFUGAL BLOWERS • TURBOCHARGERS • TUBE CLEANERS • STRAINERS

CROCKER-WHEELER DIVISION • RIDGWAY DIVISION

6 Reasons why you get greater accuracy with Bristol Series 500

RECORDING VOLTMETERS AND AMMETERS



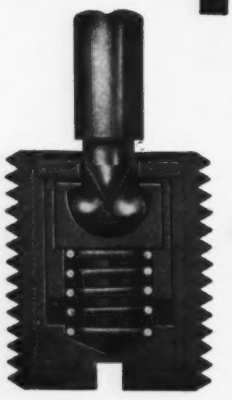
1. Low burden—the lowest burden of any round-chart recorder on the market.
2. Extremely high torque gradient.
3. Temperature compensated.
4. Shock-proof moving element mounting.
5. Leveling of instrument not critical.
6. Continuously legible recording on sudden changes—up to full scale value.

Bristol Recording Voltmeters and Ammeters use moving-iron measuring mechanisms, known for high torque . . . refined by Bristol engineers for greater accuracy and ruggedness.

Advances in electrical measurement naturally come from Bristol, experienced for nearly 60 years in building hundreds of thousands of recording voltmeters and ammeters for almost every application . . . the finest, most dependable products.

Series 500 Voltmeters and Ammeters are designed for easy use, with dust- and moisture-proof die-cast aluminum case; quick-set chart hub for easy chart changing; non-obscuring pen lifter; and snap-on chart plate.

Find out all about these superior instruments by writing for Bulletin E1111 to THE BRISTOL COMPANY, (116) Bristol Road, Waterbury 20, Conn.



Permanent mounting offered in three models: interchangeable surface and flush, surface-panel and flush panel. Note the pleasing, well-balanced appearance. Also, *portable instruments* are offered in two models: for setting on floor or table; for mounting on walls or poles and general service.

New ball-bearing suspension, loaded by a coil spring, prevents damage even under severe mechanical shock. Stainless steel bearings and shaft are almost tool hard and are corrosion-resistant.

BRISTOL

The dependable Guidepost of Industry

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

APPROVED

SAFETY CANS

For general use wherever flammables are employed at any point within the plant. Have electrically seamwelded, sturdy bodies reinforced by beading. Fire baffle is a double concentric cylinder inside the base of the spout. Spring-loaded cap is mounted on a ball and socket joint to automatically make a tight, complete closure. Squeeze-grip handle is wide, oval, roomy. Ease and positive control while pouring.

For more than a quarter-century The Protectoseal Company has devoted its entire research and engineering organization and its modern manufacturing facilities exclusively to the production of a complete line of containers and devices for the safe control and handling of flammable liquids.

These years have seen an enormous increase in the use of flammables by industries of widely different types and natures, and today there is hardly a shop or plant or process which does not make every-day use of flammables at some point, if only when cleaning and finishing.

It is extremely important, therefore, not only that life and property should be thoroughly safeguarded against the dangers inherent in these flammables, but that there should also be no interference with or slowing down of production; and it is Protectoseal's insistence upon "Protection with Production" that has made Protectoseal products preeminent in industry.

A COMPLETE LINE OF PLANT SAFEGUARDS

There is a Protectoseal product for the safe handling of flammables at every point from receiving and storage through use in maintenance and operation. To assist you in safeguarding your properties completely, a series of Self-Checking Charts have been prepared and are available without cost as a safety service to industry.

APPROVED

OILY WASTE CANS

A necessity in every shop or plant for the safe placement of oily or solvent-soaked rags, cleaning swabs and other waste shop material; required by many insurance companies. Permanently closed can is of sturdy seam-welded construction. Full length cover hinge for permanent alignment. Opens wide by slight foot pressure at any point on full-width treadle for easy use.

Approved by Underwriter's Laboratories, Inc., and Associated Factory Mutual Fire Insurance Companies

THE PROTECTOSEAL COMPANY
1906 S. Western Avenue, Chicago 8, Illinois • In Canada: Safety Supply Co., Toronto

The Protectoseal Company
1906 S. Western Avenue, Chicago 8, Illinois
Please send the informative literature checked below:
____General Plant and Laboratory Container Catalog
____Catalog of Vents and Fittings for Bulk Storage
____Self-Checking Charts
Name_____
Title_____
Company_____
Address_____
City_____Zone____State_____

HV Transmission Unlimited

Successful completion of a commercial type power transformer for a 600-kv transmission line gives the electric power industry a proved means for raising transmission voltages far beyond present levels.

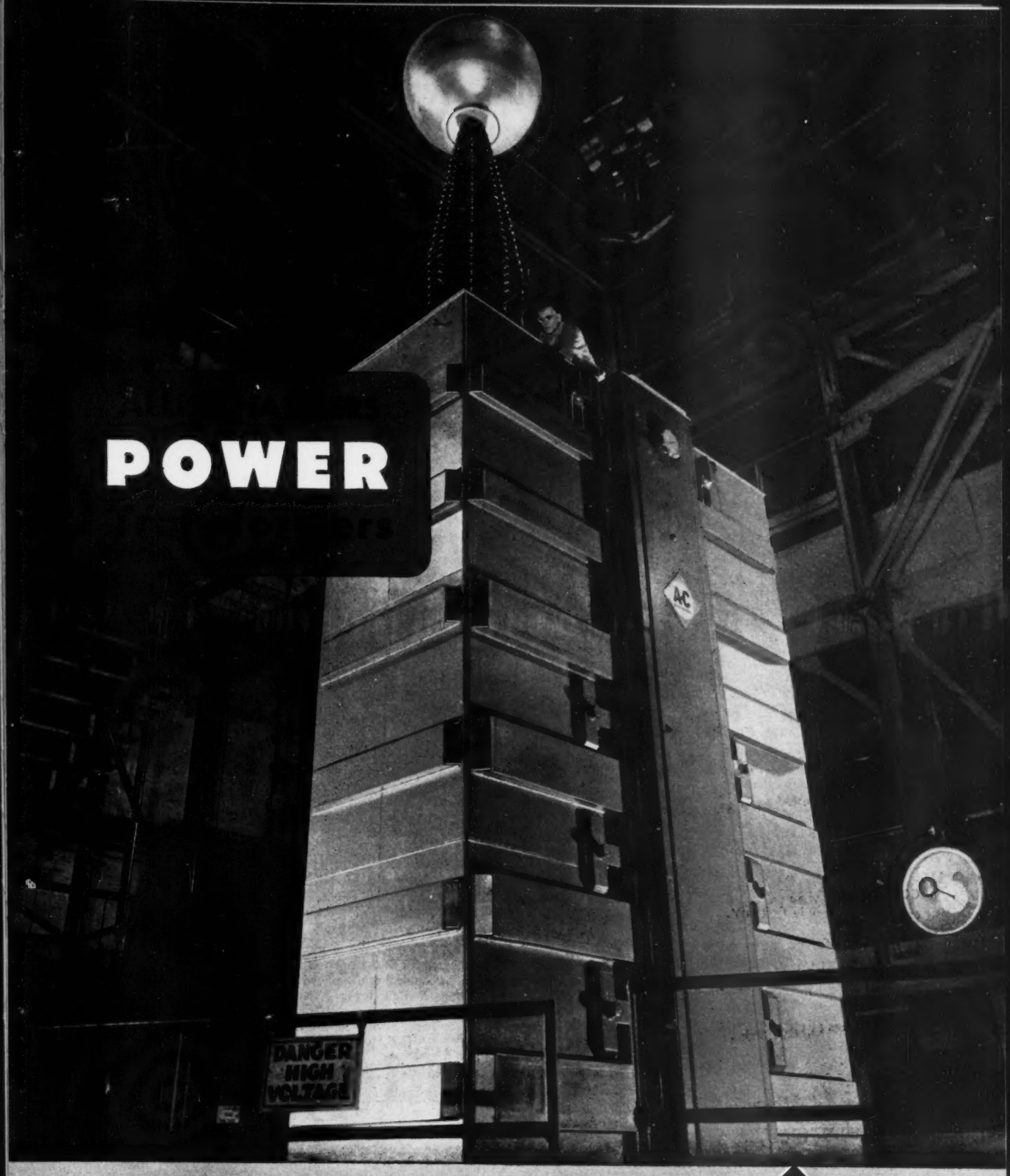
New insulation techniques developed at Allis-Chalmers are primarily what made the new unit possible. In addition, a special experimental bushing had to be designed and built by A-C engineers. Other notable features include use of the tank for clamping core and coils, very low oil requirement, and light weight in proportion to kva capacity.

It is a two-winding unit rated 5000 kva, single-phase, low voltage 2400/4800 volts, high voltage 600,000 volts to neutral. It was given impulse tests of 1600 kv full wave, 1850 kv chopped wave. It has sufficient strength to permit operation on a 600-kv solidly grounded transmission line with lightning arresters now available — possibly on an 880-kv transmission line in the future. And, like all Allis-Chalmers power transformers, the unit is Corona-Free.

The construction of this transformer has produced useful design and manufacturing experience. It will result in concrete advantages to buyers of Allis-Chalmers power transformers in all voltages. A-4178

Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-

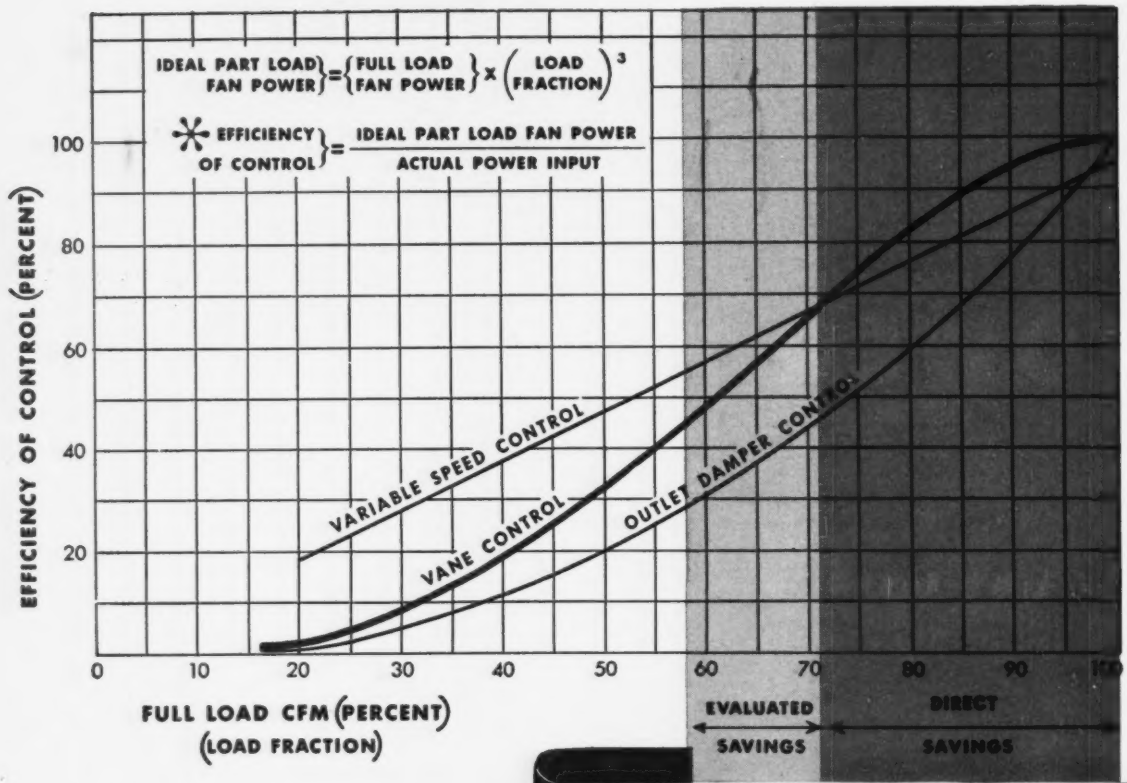


CHALMERS

A-C
ALLIS-CHALMERS

FOR PART LOADS

USE STURTEVANT VANE CONTROL® FOR HIGH EFFICIENCY AT LOW COST



If you operate in this range—and most plants do — VANE CONTROL is the economical choice

Have you ever considered the relative efficiencies of methods of mechanical draft fan volume control—and then evaluated them against first cost? Do so, and you will find Sturtevant Inlet VANE CONTROL is the best. It is high in *efficiency of control** and low in first cost.

Whether for forced or induced draft, the *new* VANE CONTROL is a simple and reliable regulator of fan output—a control which responds instantly to varied demands, and yields major power savings at reduced loads.

A new Bulletin, DB 92-810, describes the mechanical improvements developed for Sturtevant VANE CONTROL and its use in mechanical draft, industrial and ventilating applications. Write today for a free copy. Westinghouse Electric Corp., Sturtevant Division, **157** Damon St., Hyde Park, Boston 36, Mass.

YOU CAN BE SURE...IF IT'S **Westinghouse**

PUTTING *Air* TO WORK

J-80220

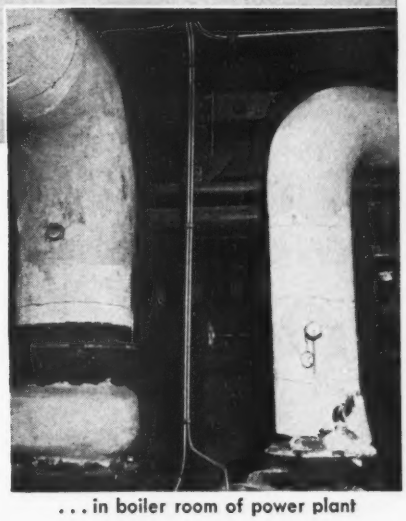
Most Dependable for Lighting, Control and Machine Wiring!

SAFETY m.i. WIRING SYSTEM*

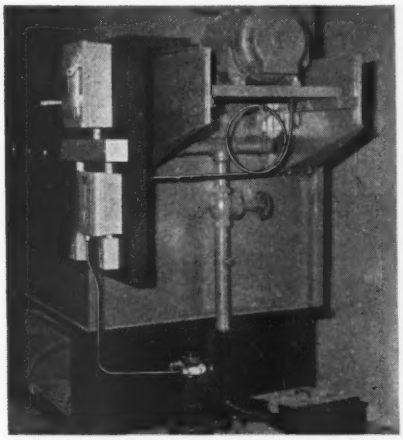
(PYROTENAX)®

RESISTS HEAT! An ideal wiring system in boiler rooms, around steam pipes, boiler stacks, etc. It will neither burn, support combustion nor convey flame! The mineral insulation of Safety m.i. Wiring is physically stable up to 2800°C., thereby assuring against deterioration by heat, even beyond the melting point (1083°C.) of the copper sheath.

COMPLETELY MOISTURE-PROOF! Simple fittings permanently seal both ends of each run of wiring. No possible entrance for moisture. Normal concern over this hazard is thereby completely eliminated.



. . . in boiler room of power plant



. . . in freezer unit of cold storage plant

Only new, Underwriters' Approved Safety m.i. Wiring System gives you these outstanding features as well:

- thrifty one-step installation
- no vapor passage
- rigid yet flexible
- permanence—actually outlasts structures in which it is installed

Make installation easier, save time and money. Write direct or see your nearest General Cable office for the latest information.

*Exclusively a General Cable Product

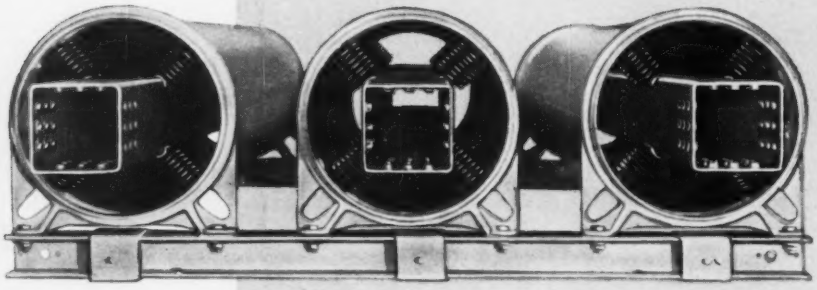
GENERAL CABLE
CORPORATION

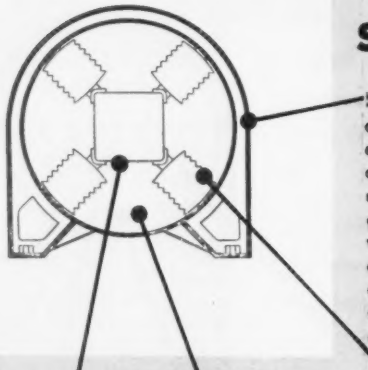
Executive Offices: 420 Lexington Avenue, New York 17, N. Y. • Sales Offices in Principal Cities of the United States

What Isolated Phase Bus is

Transmitting huge quantities of electrical energy at generated voltage is a job for an especially reliable type of conductor. Generator leads, transformer leads, feeders, and main and transfer buses in generating and distribution stations form key links in the nation's power networks. They must possess high dielectric and mechanical strength.

I-T-E Isolated Phase Bus is designed to meet all these electrical and mechanical essentials. It is a structure of heavy copper conductors, one to a phase, each enclosed in its own grounded metal shield. This basic design characteristic completely eliminates phase-to-phase faults in the most economical way possible.





Simplicity is the keynote

SUPPORTING RINGS of strong cast aluminum connect the light metal cover electrically and mechanically to grounded plant steelwork. Tightly gasketed aluminum covers make a single design suitable for indoor or outdoor use.

CONDUCTORS— one for each phase— are of copper or aluminum in round or square cross-section. Lengths up to twenty-four feet are joined end to end with solid, flexible, or braided connectors.

AIR SPACE insulation is unchanged by heat or age. Because air is free and inexhaustible, it does not have to be replenished or kept under pressure.

INSULATORS are of solid, non-aging porcelain, radially disposed to withstand compression. Insulators cradle conductors to allow free movement when conductors expand or contract.

The construction of I-T-E Isolated Phase Bus is as simple as its neat appearance suggests. Complete phase isolation—the fundamental requirement—is achieved through the arrangement and construction of conductor, insulator, and housing.

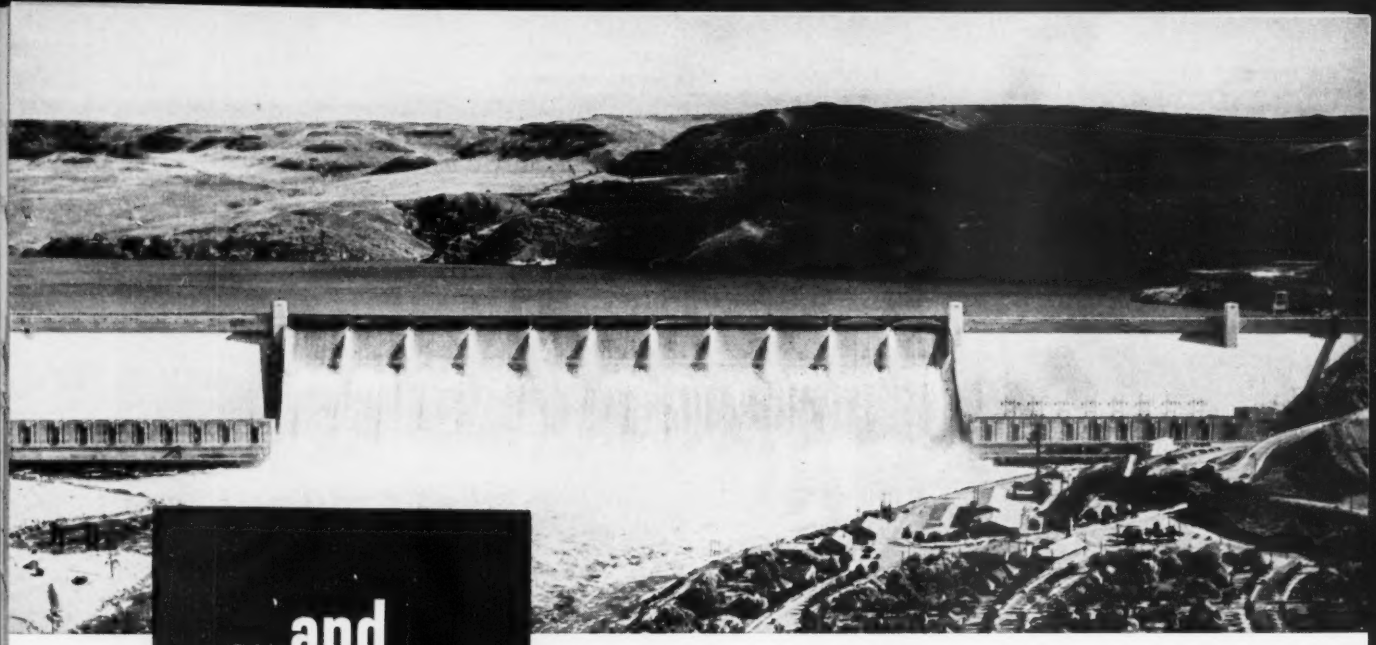
Light weight, freedom of movement for conductors, adequate cooling, and other requirements are provided for through use of a few simple parts.

For details, check the I-T-E Application Engineer nearest you.

ISOLATED PHASE BUS

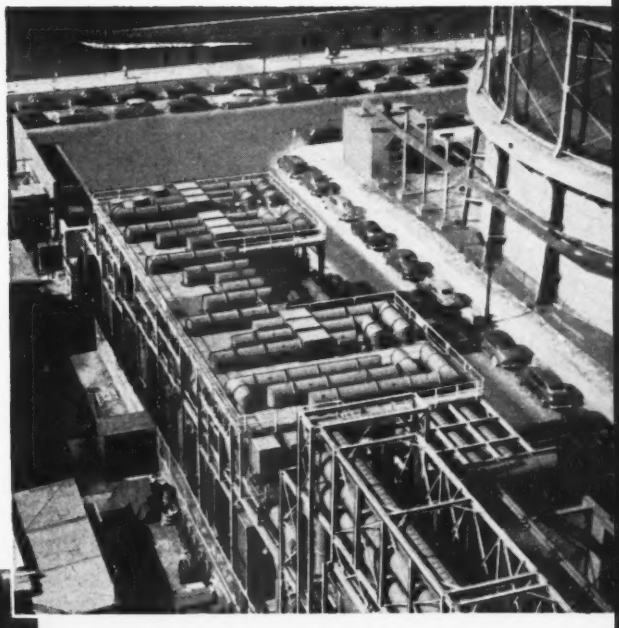
I-T-E CIRCUIT BREAKER CO. • 19th and HAMILTON STS. • PHILA. 30, PA.

R&IE EQUIPMENT DIVISION, GREENSBURG, PA.

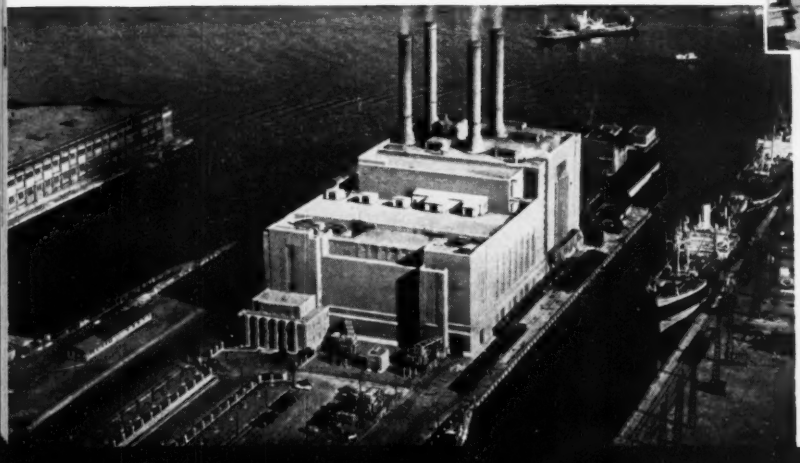


...and where it is used

Hydroelectric generators—
including the world's largest waterwheel-driven machines, deliver vast quantities of power through safe I-T-E Isolated Phase Bus runs.

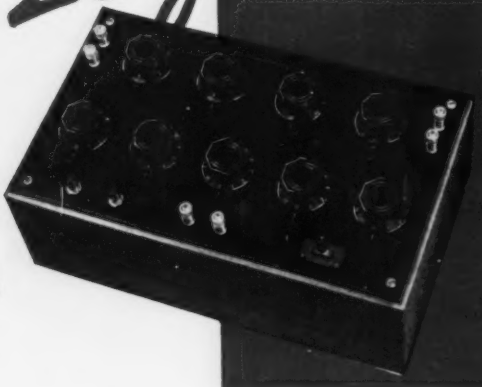


Steam plants—
are being built with larger and larger generators. I-T-E has design experience and production facilities to keep pace with the nation's expected power expansion and with rapid increases in generator output ratings.



Switching stations—
of the most modern types use I-T-E Isolated Phase Bus runs to connect transformers and distribution switchgear. The installation pictured here employs 69-KV bus structures at a utility central station.

"We have used D-H MANGANIN for 25 years..."



DOUBLE-PURPOSE BRIDGE. This Shallcross Model 6320 Wheatstone Limit Bridge can be used both for exact resistance readings and, in production, for rapid checks on percent deviation from an accepted standard. Overall range extends from 0.1 ohms to 111,110,000 ohms. All resistors are D-H Manganin.

Says **SHALLCROSS MANUFACTURING COMPANY,** Collingdale, Pa.: "For 25 years we have been using Driver-Harris Manganin wire in the construction of Wheatstone and other precision bridges. In addition, D-H Manganin alloy has been used in many special standards for research and development laboratories. We feel that the quality of our products and the reputation of our instruments have been greatly enhanced by its use."

Behind statements like these stand Driver-Harris production and drawing techniques, which provide Manganin of such fixed stability that maximum change in resistance between 15°C and 35°C is only about 15 parts per million per degree centigrade—and frequently *less than one-third this* amount. Equally good electrical characteristics are available for ammeter shunt stock operating between 40°C and 60°C.

The experience of Shallcross reflects the experience of a host of manufacturers throughout the country; reflects what *you* can expect from Driver-Harris products, whether Manganin or any of the numerous alloys developed by Driver-Harris for application in the electrical and electronic fields.

Whatever your alloy problem, therefore, let us have your specifications. We'll gladly put at your disposal the skills acquired from 50 years of alloy manufacturing experience . . . make recommendations based on your specific needs.

*T. M. Reg. U. S. Pat. Off.

*Sole producers of world-famous Nichrome**

Driver-Harris Company

HARRISON, NEW JERSEY

BRANCHES: Chicago, Detroit, Cleveland, Los Angeles, San Francisco

In Canada: The B. GREENING WIRE COMPANY, Ltd., Hamilton, Ontario.

MAKERS OF THE MOST COMPLETE LINE OF ELECTRIC HEATING, RESISTANCE, AND ELECTRONIC ALLOYS IN THE WORLD

NO FINER WRENCH ANYWHERE!

CRESTOLOY Wrenches are forged from a special alloy steel permitting thinner, trimmer design with greater strength and less weight than conventional adjustable wrenches. Their chrome plate finish is as durable as it is handsome. Choose CRESTOLOY Wrenches for outstanding performance in the toughest kind of service. Sold by hardware dealers everywhere.

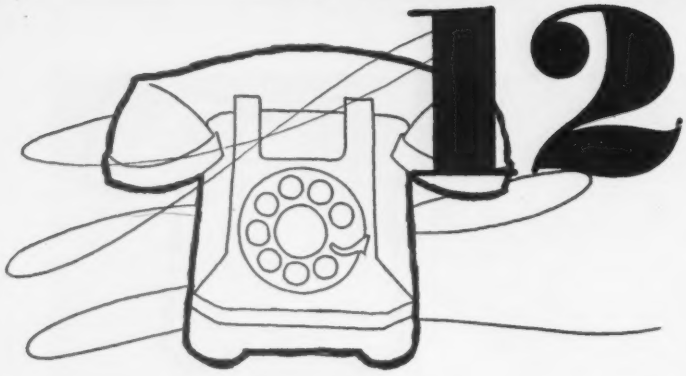
8 SIZES IN SINGLE & DOUBLE END TYPES

Number	Size	Capacity
AC14	4"	1/2"
AC16	6"	3/4"
AC18	8"	15/16"
AC110	10"	1-1/8"
AC112	12"	1-5/16"
AC115	15"	1-11/16"
AC118	18"	2-1/16"
AC124	24"	2-7/16"
BC146	same as 4" and	6" above
BC168	" 6" "	8" "
BC1810	" 8" "	10" "
BC11012	" 10" "	12" "

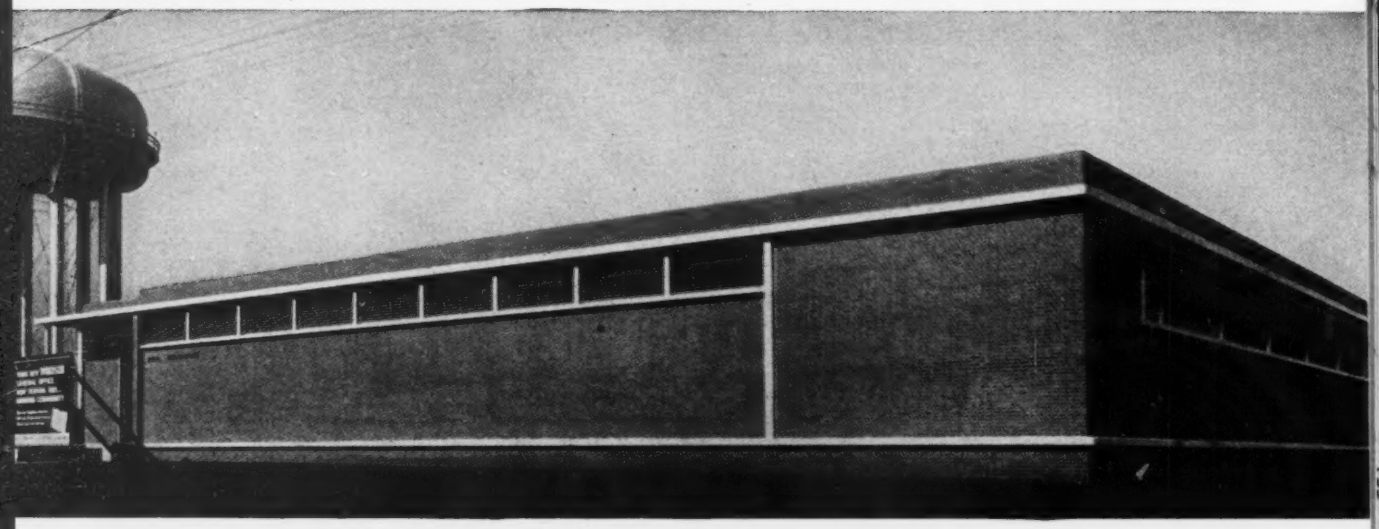
CRESCENT TOOLS
Give Wings to Work
®
Sign of the Artisan
Symbol of Excellence

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK



12 KUHLMAN *help bring new subscribers*



Beautiful, modern building of the new Windsor exchange of The Bell Telephone Company of Pennsylvania in the lower Delaware Valley near Philadelphia, Pennsylvania.

Over the past five years, Kuhlman Electric Company has furnished twelve Unit Substation Transformers to new exchanges and central offices of The Bell Telephone Company of Pennsylvania in the Delaware Valley, bringing service to many thousands of new subscribers. One of these twelve transformers, a 300 KVA, three-phase, STK unit, installed in the new $1,150,000 Windsor exchange, will eventually serve 20,000 subscribers in the lower Delaware Valley where U. S. Steel's sprawling Fairless Plant has created an industrial boom, unprecedented in recent years.

The selection of Kuhlman Substation Transformers for these installations will help insure regular, uninterrupted service to the new subscribers and provide efficient, low-cost operation for the telephone company.

Kuhlman Transformers are specifically engineered to the requirements of industries and utilities. Incorporating many advanced technical features developed and perfected by Kuhlman, they are built from carefully selected materials and assembled by men with many years of experience in the electrical crafts. Before delivery, they are thoroughly inspected and given all required ASA tests. Rugged construction and simplicity of design is the key to their safe, dependable performance and extremely long service with a minimum of attention. Kuhlman manufactures Power, Distribution, Dry-Type, Safe-T-Kuhl, Subway, CSP and Series Street Lighting Transformers. For complete information about any of these units, write us today.

Kuhlman **ELECTRIC COMPANY**

TRANSFORMERS

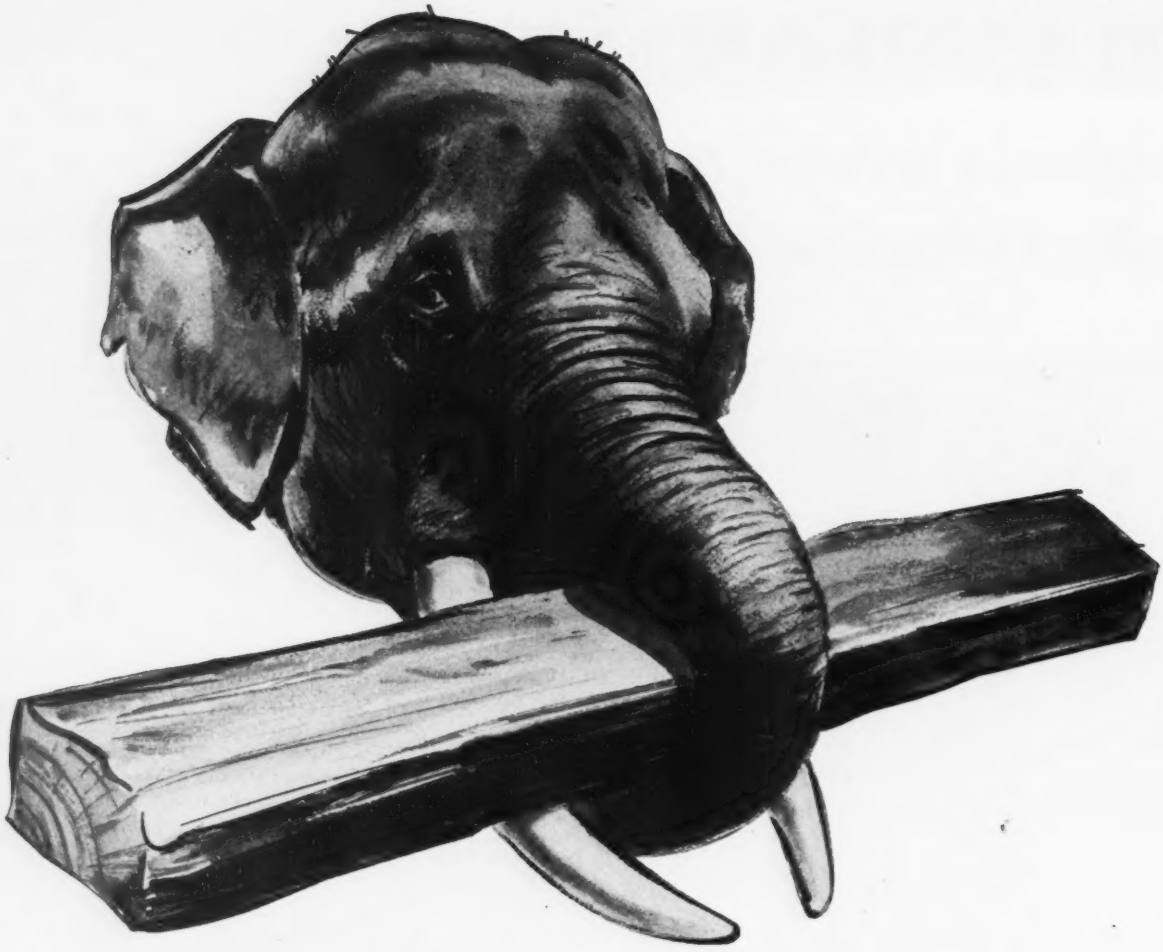
telephone service to thousands of in the Delaware Valley

Left: The Kuhlman Substation Transformer installed in the Windsor exchange. Moody and Hutchison of Philadelphia were consulting engineers on the Windsor project. The switchgear was supplied by Pringle Electrical Manufacturing Company of Philadelphia, and the electrical contractor was H. B. Frazer Company of Philadelphia.

Below: The Kuhlman Substation Transformer with throats ready for shipment to The Bell Telephone Company of Pennsylvania for installation in the new Windsor exchange. The transformer has been fully inspected, and rigorous operating tests have been run. Kuhlman also makes flush end design substation transformers.

BAY CITY, MICHIGAN • SOUTHERN DIVISION • CRYSTAL SPRINGS, MISSISSIPPI

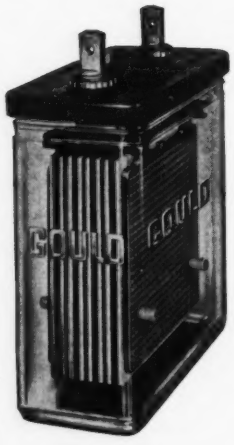
EXPORT REPRESENTATIVES: *International Standard Electric Corporation,* 67 Broad Street, New York 4, N. Y. Cable Address, Microphone, N. Y.



RESERVE STRENGTH For Emergencies

THANKS TO BATTERY POWER!

All standby batteries are *not* alike. Gould Planté is different. It is the only battery available today with positive plates of pure lead—plates that enable the battery to renew itself as it floats. Whether you need a powerful surge or a steady flow, Gould Planté has abundant power in reserve, ready for emergencies today, tomorrow or years from now.



Specify
THE GOULD PLANTÉ
The Aristocrat of
Stationary Batteries

GOULD INDUSTRIAL BATTERIES

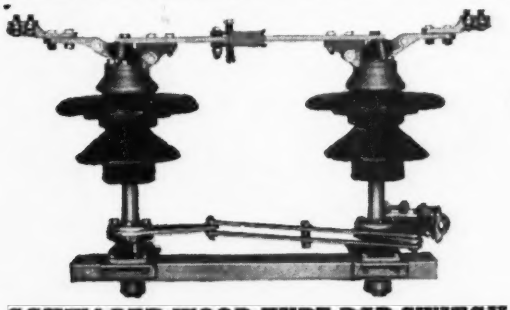
GOULD-NATIONAL BATTERIES, INC., TRENTON 7, N. J.

Always Use Gould-National Automobile and Truck Batteries

©1953 Gould-National Batteries, Inc.

HORIZONTAL BREAK SWITCHES

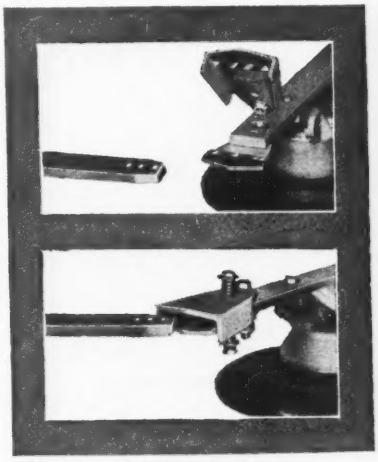
Ideal switch for conditions demanding low original cost, ease of installation and minimum maintenance expense for bypassing, disconnecting and bus sectionalizing. Can be mounted horizontally, vertically and in an inverted position. The individual poles of these switches can be mounted in a horizontal or vertical configuration.



SCHWAGER-WOOD TYPE DSB SWITCH

(Illustrated: 34.5 KV-600 Amperes)

Group operated horizontal break switch with *two* rotating insulator stacks per single pole. Available in voltage ratings of 23 KV to 69 KV in current ratings of 400 and 600 amperes, and in voltage ratings of 115 KV and 161 KV in current ratings of 600 and 1200 amperes.



The contact shoe is designed to protect the silver to silver contact points. Ease of operation is assured under all weather conditions.

Technical information and prices available on request from any of our regional representatives or the home office, 8024 S.W. 35th Avenue, Portland 19, Oregon. Phone CHerry 7588

SCHWAGER-WOOD CORPORATION

High Voltage Switchgear • Substation Design, Equipment • Bus Fittings, Connectors **PORTLAND, OREGON**

BAY CITY, MICHIGAN
P. O. Box 287
Johnson Sales Co.
Phone 3-6413

BILLINGS, MONTANA
P. O. Box 619
Victor L. Wisoki
Phone 9-3175

BIRMINGHAM, ALABAMA
447 American Life Bldg.
Walter E. Thompson Co.
Phone 7-1017

CHICAGO, ILLINOIS
542 S. Dearborn St.
Central States Eng. & Prods. Co.
Phone WAbash 2-1824

DALLAS, TEXAS
P. O. Box 8071
Tate-Scanlon Co.
Phone Lakeside 1473

DENVER, COLORADO
100 13th Avenue
Slaybaugh-Thompson Co.
Phone AComa 5826

DES MOINES, IOWA
5707 Waterbury Circle
Charles L. Ward Co.
George W. Swallow
Phone 7-4769

EL PASO, TEXAS
P. O. Box 347
Phillips Electric Eqpt. Co.
Phone 3-1611

KANSAS CITY, MISSOURI
3122 Roanoke Road
Charles L. Ward Co.
Phone Valentine 8895

NEW YORK 7, N. Y.
125 Barclay Street
Russell D. Heath
Phone DIgby 9-1500

OKLAHOMA CITY 14, OKLA.
3125 N. W. Grand Blvd.
Charles L. Ward Co.
Harold E. Bates
Phone VIctor 3-3737

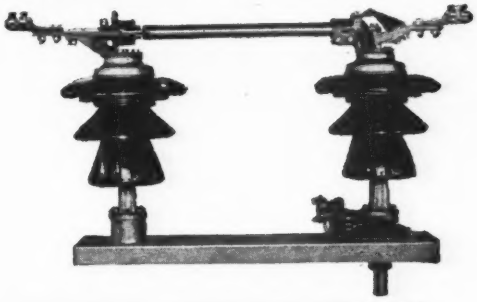
PASADENA, CALIFORNIA
P. O. Box 67-C
A. B. Smedley
Phone Sycamore 8-3919

PITTSBURGH, PA.
37 Alton Drive
Robert R. Kovach
Phone COlonial 3-6296

SALT LAKE CITY, UTAH
550 W. 7th S.
Clarence W. Silver Co.
Phone 5-5378

SAN FRANCISCO, CALIF.
461 Market Street
K. M. Ryals Co.
Phone YUkon 2-5510

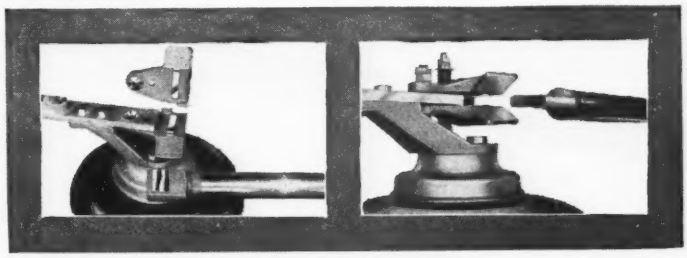
TACOMA 2, WASHINGTON
1914 Market Street
Love Electric Co.
Phone BR 4104



SCHWAGER-WOOD TYPE SSB SWITCH

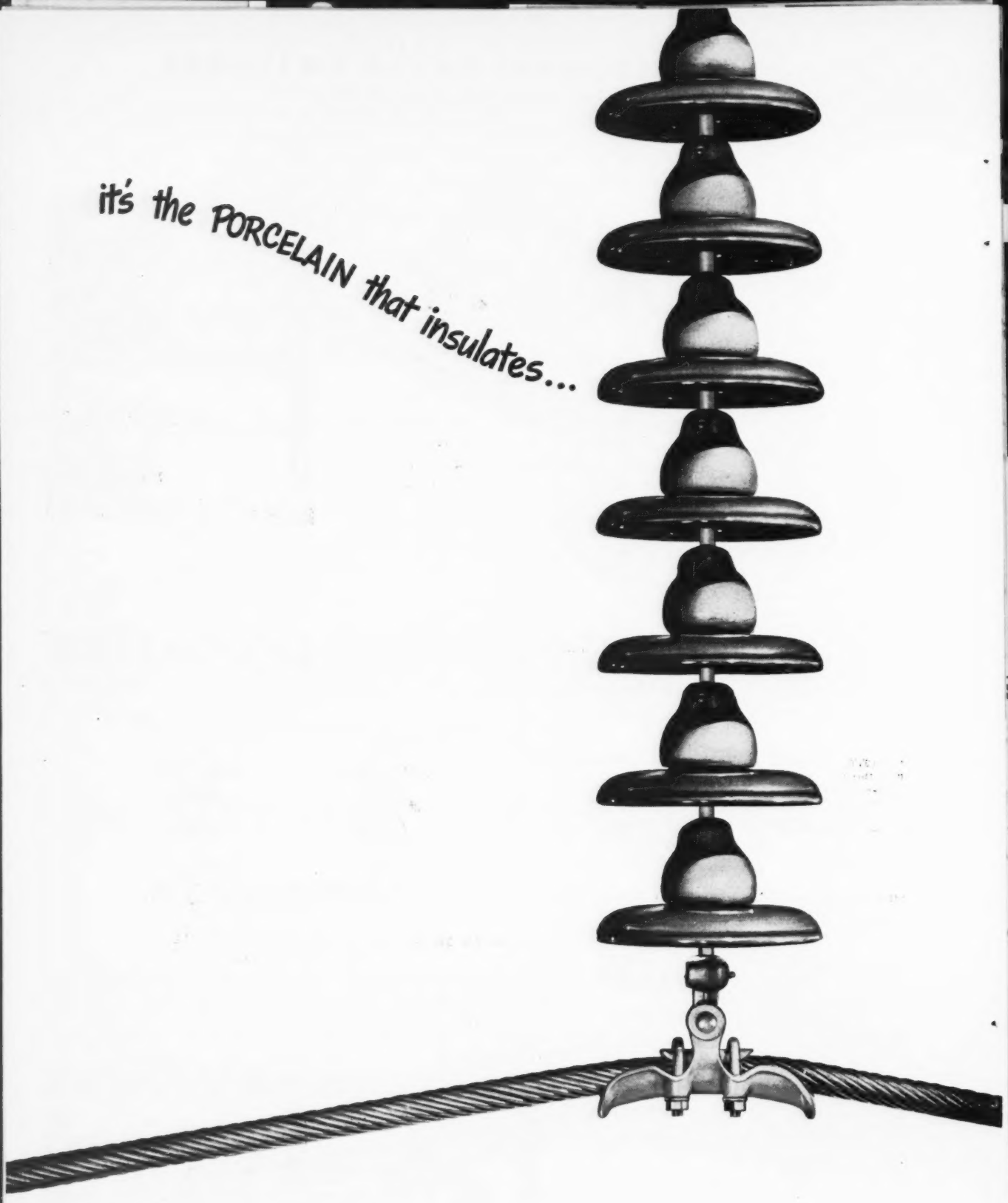
(Illustrated: 46 KV-600 Ampere)

Group operated horizontal break switch with *one* rotating insulator stack per single pole. Available in voltage ratings of 7.5 KV to 34.5 KV in current ratings of 400, 600 and 1200 amperes and in voltage ratings of 46 and 69 KV in current ratings of 600 and 1200 amperes.



Generous use of silver assures perfect contact.
Knee-action is provided for easy all-weather operation.

it's the PORCELAIN that insulates...



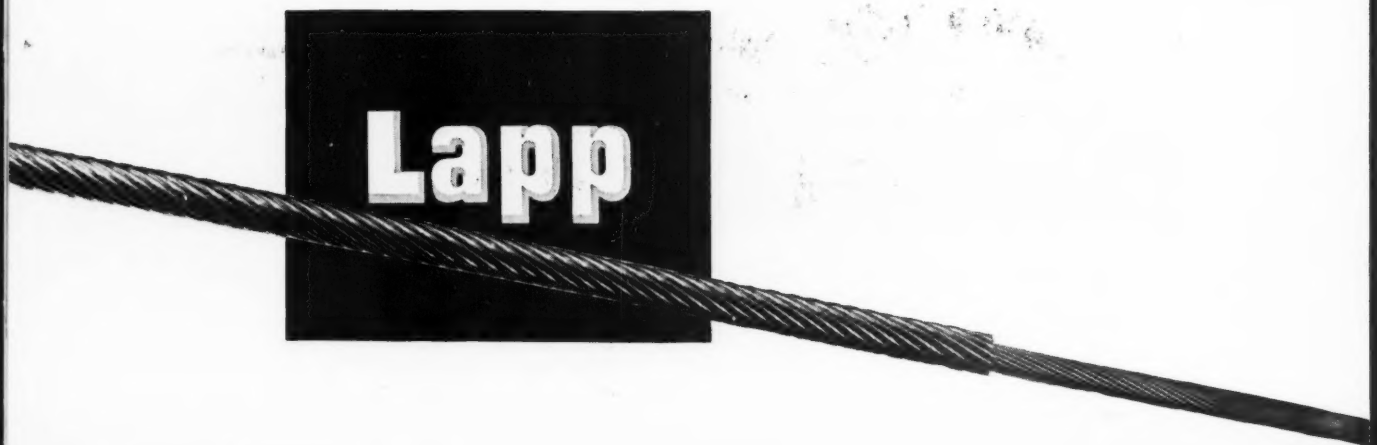
LAPP PORCELAIN

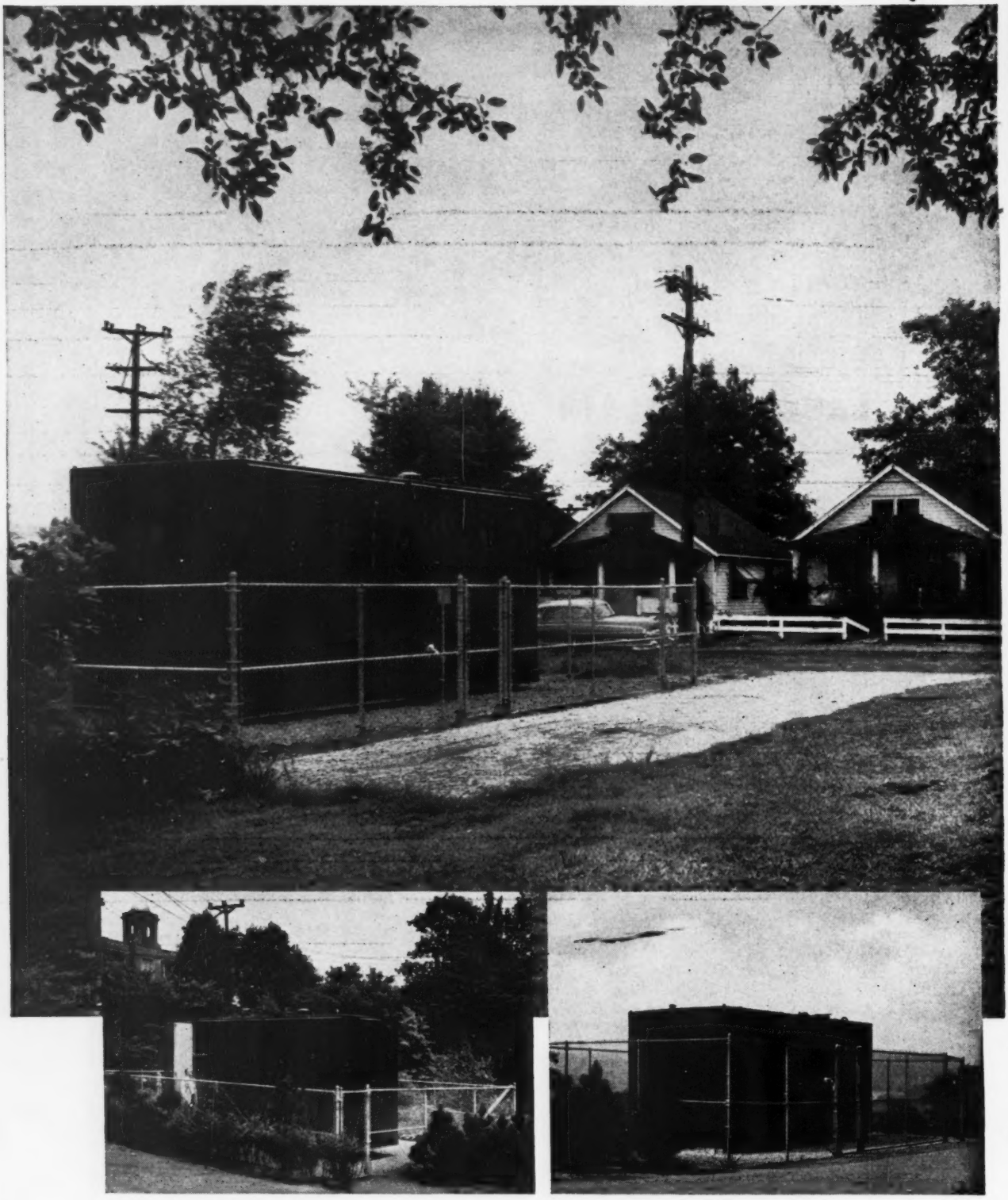
IS YOUR GUARANTEE

OF LONG INSULATOR LIFE

Insulator life depends on soundness of porcelain, and on assembly which gives it the best chance to live. For greatest insulator serviceability, look to the quality of the porcelain, and to assembly which recognizes the physical characteristics of the porcelain. Nowhere have these two requirements been the subject of more study, nor the object of more production care than at Lapp. The Lapp reputation for porcelain quality is ample basis for your confidence in the specification *"Lapp Suspension Insulators."*

Lapp Insulator Co., Inc., Le Roy, N. Y.





This "CSP®" Power Transformer, rated 2000 kva, HV 22.9 kv, LV 4360 volts, was designed by Westinghouse in cooperation with Duquesne Light Co. of Pittsburgh, to meet their specific requirements. Installed in North Bessemer, Pa., it is neat in appearance, contains complete high and low-voltage switchgear, metering and protective equipment.

"Contoured-design" units, like this installation in McKeesport, Pa., may help solve substation problems for you, too. Complete enclosure enhances the safety factor, simplifies landscaping problems. Ask your Westinghouse representative for further information, or write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

"One of the best neighbors I've ever had . . . !"

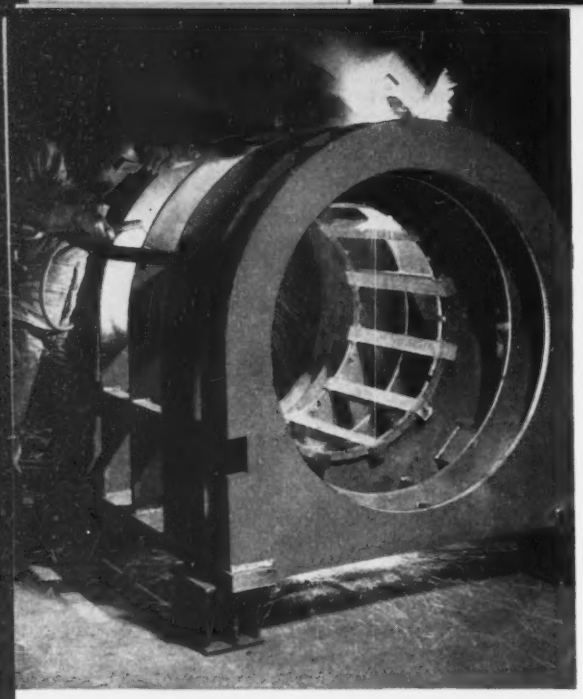
"The Westinghouse substation next to my house at 1222 Twenty-fifth Street Extension, Beaver Falls, Pennsylvania, is one of the best neighbors I've ever had," says Mrs. Roy W. Thompson, shown at the side entrance to her home.

"Recently I acquired a new neighbor, the one shown here. Westinghouse Electric Corporation and Duquesne Light Company, who worked together to develop this unit, call it a contoured-design, single-circuit substation. I'm not sure what all that means, but I can see why they call it contoured. It's completely enclosed in what looks like a large cabinet—not at all like some substations I've seen . . . the Duquesne Light people have explained to me that the enclosure not only makes the installation attractive, but completely safe, and that even without the fence there would be no danger. And, after Duquesne Light shrubs around the fence, we'll hardly know it's there because it certainly is quiet. Even my TV reception is better—they say that's because of better voltage regulation. Maybe so, anyway, I like my new neighbor."

J-70710

YOU CAN BE SURE . . . IF IT'S

Westinghouse



The a b c's of NEWEST large 2-pole Induction Motor Construction

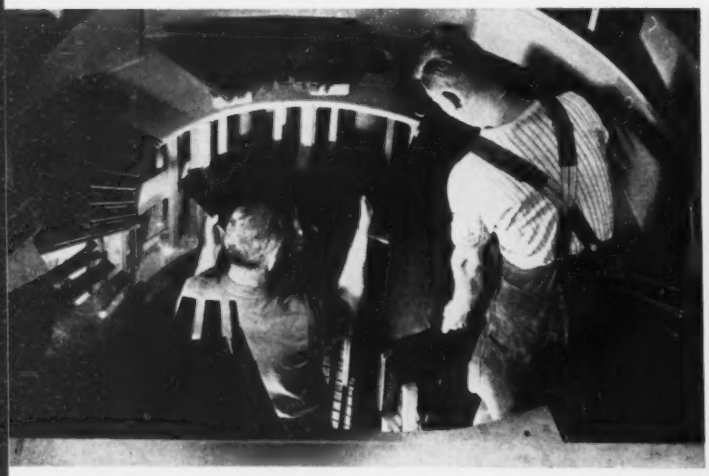
Here's a picture sequence showing a big E-M 2-pole boiler feedwater pump motor* in construction. Step by step you can observe the modern engineering and meticulous care given to every detail by E-M craftsmen. The little rhymes will call your attention to the key points in each picture.

As you know, requirements for big motors are exacting . . . the duty severe. Here you can see how E-M builds in extra quality to give you top performance, reliability, smooth operation and economy. The E-M sales engineer in your area has many more interesting facts on these big E-M Motors he'll be glad to tell you.

*E-M 2-pole Heavy-Duty Squirrel-Cage Induction Motor (1500 hp and larger)

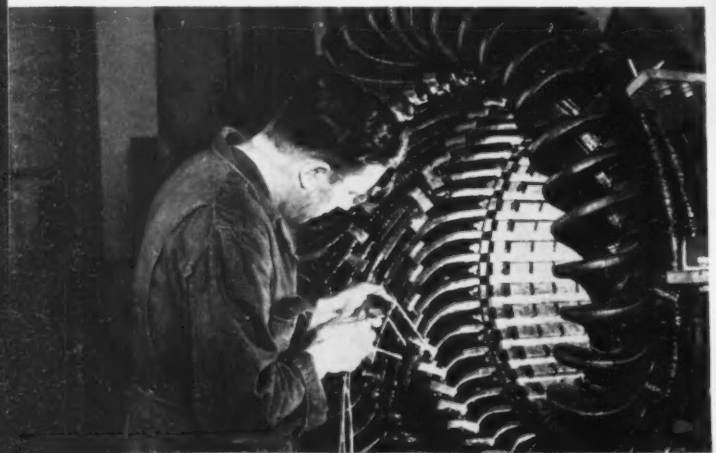
a

A's for All-welded, this reinforced frame;
It's made extra rugged to stay in the game.
All welds are continuous, tested for strength—
There'll be no distortion in width or in length.



b

Burrs are removed before laminations are stacked,
For a low-loss core that is true and compact.
The baked-on enamel coating of each lamination
Provides high dielectric strength and corrosion elimination.

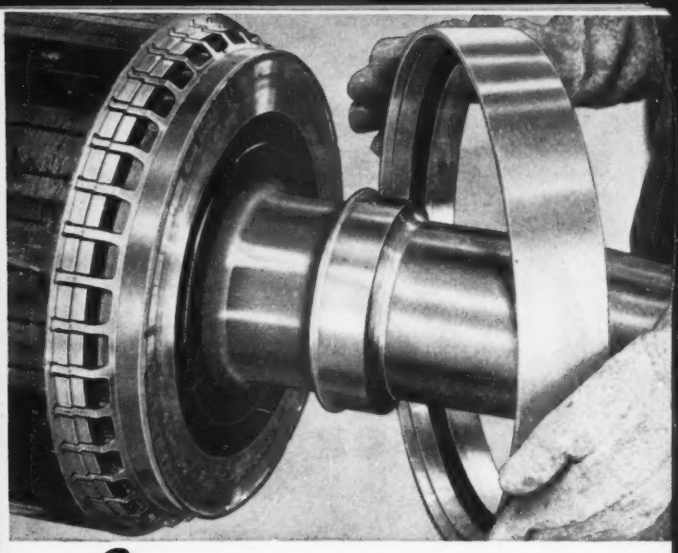


c

C is for Coils, with vacuum impregnation
To provide the best in protective insulation.
They're form-pressed to slot size to fit on the dot . . .
Each coil is surge-tested before reaching its slot.

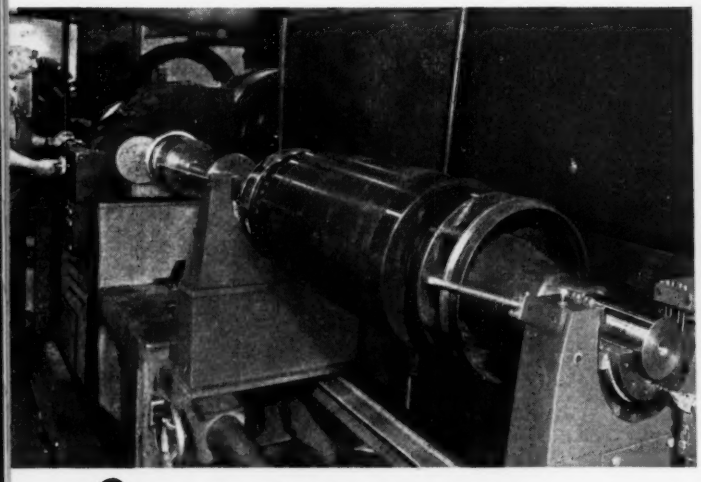
d

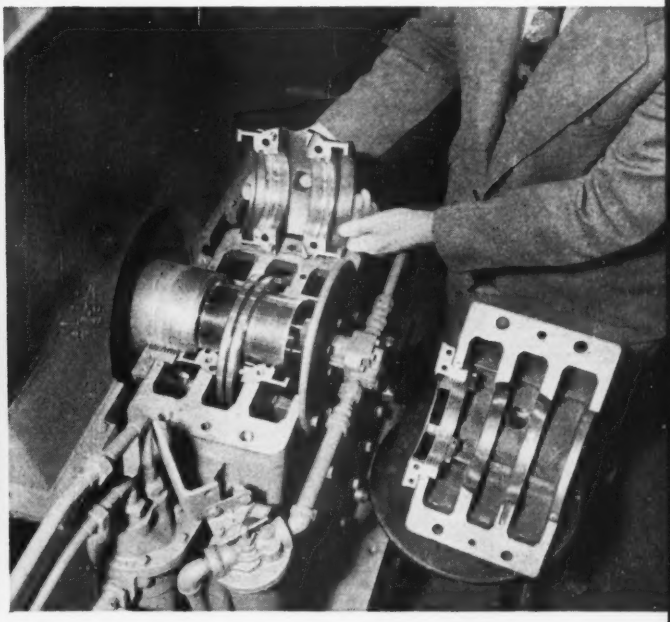
D is for Diligence in anchoring the winding . . .
Each coil side is lashed to provide an "arch" binding.
These tight E-M coil ends won't be twisting or parting
In any hard demand of full-voltage starting!



f F is for Freedom from centrifugal force distortion,
In end-ring structure and retaining ring portion.
The cage bars fit rotor slots snug and tight—
Joints are silver-brazed; they stay just right.

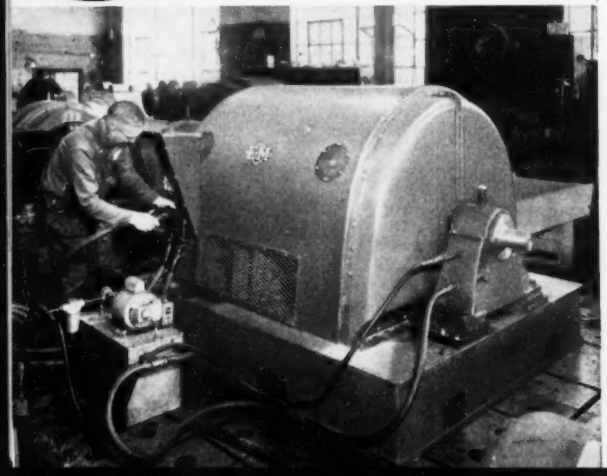
e Extra protection for the E-M wound stator . . .
It's full-flooded with varnish—a real first-rater!
It's baked and re-flooded and re-baked at a pace
That seals the coil surface in every place.





g G is for the Gisholt electronic machine
That checks rotor balance with an eye true and keen.
Again in the stator we check balance of the rotor
Because it's so important to a smooth-running motor.

h High finish on journals, superfinish is the rule.
The bearings are well-sealed . . . they'll run long and cool.
The sleeves are Kolene-processed to last and last.
Double oil rings start lubrication safe and fast.



i Inspection is thorough, when we've done all the rest,
For each E-M machine stands a rigorous test.
When it's installed in your plant, you know it can take it . . .
It's bound to be rugged, for it had experts to make it!

Like to know more about this 2-pole Motor beauty
For feedwater pumps or other hard-driving duty?
Just call your nearest E-M sales engineer now
For facts, data and application know-how.
Or write to the factory—there's much you can glean
From E-M's new brochure Number 214.

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

1300-TPA-2162

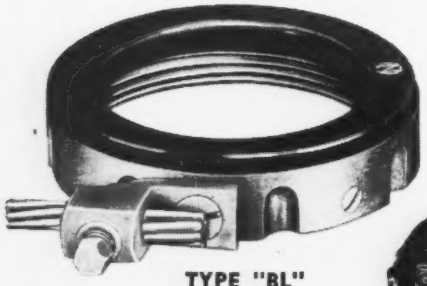
E-M

Specialists in making motors do exactly what you want them to

THERE'S AN O.Z. BUSHING FOR EVERY JOB

TYPE "B"

Strongest insulating bushing available! Exclusive design permanently locks insulation into casting.



TYPE "BL"

Same as proven Type "B" with lug for quick, positive ground connections. Set screw in casting facilitates positioning.

Finest, high-strength, all-Bakelite insulating bushing. A top quality bushing—competitively priced!

TYPE "A"

All-Bakelite bushing with male thread for insulation of exposed cables passing through holes in metal boxes or troughs.

TYPE "BB"

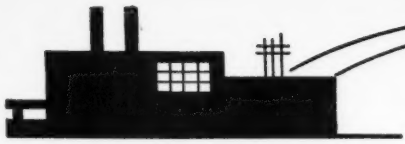
Over 35 years of specialized experience in the design and manufacture of conduit fittings is behind the complete line of O.Z. insulating bushings. Whatever your insulating bushing problem, you can be sure there is an O.Z. design to fit your application perfectly. Buy O.Z. bushings from your local electrical distributor.

O.Z. ELECTRICAL MANUFACTURING CO., INC.

262 BOND ST. • BROOKLYN 2, N. Y.

CAST IRON BOXES • SOLDERLESS CONNECTORS
CABLE TERMINATORS • GROUNDING DEVICES
POWER CONNECTORS • CONDUIT FITTINGS

Representatives in all principal cities



From Original Design to Final Installation . . .

Wheeler LIGHTING ENGINEERING follows through

Right down the line, from the original fixture design on factory drawing boards...*you know the lighting is right when it's Engineered By Wheeler!*

Yes, even at the point of actual installation, Wheeler Field Sales Engineering is constantly at your service . . . ready to aid you in planning the best Lighting Layout for any standard Commercial or Industrial installation. And whenever special lighting problems come up, again you will find Wheeler Lighting Engineering an experienced and cooperative partner.

This unique technical assistance has been available over the years to Architects, Industrial Engineers, Jobbers and Contractors at every level of field service. That's why, whatever the installation — Industrial, Commercial or Special, and whatever the problems involved . . . you can rely on Wheeler Reflector Company to provide the one best answer for your specific lighting requirements.

Wheeler Reflector Company

275 Congress St. Boston 10, Mass.

Distributed Exclusively through Electrical Wholesalers • Representatives in Principal Cities

Announcing Foster Wheeler's new

completely tooled to effectively meet your most exacting needs for steam generators, heat-transfer and process equipment!

1. 8000 TON BEAM PRESS
Hydraulically operated, will bend steel plates 40' long, 8" thick.

2. PLATE EDGE PLANER
Will take the longest available plates, for cutting welding grooves.

3. OVERHEAD CRANES
Four large cranes capable of lifting the heaviest and largest equipment easily.

4. DOUBLE HOUSING PLANER
Highest speed planing.

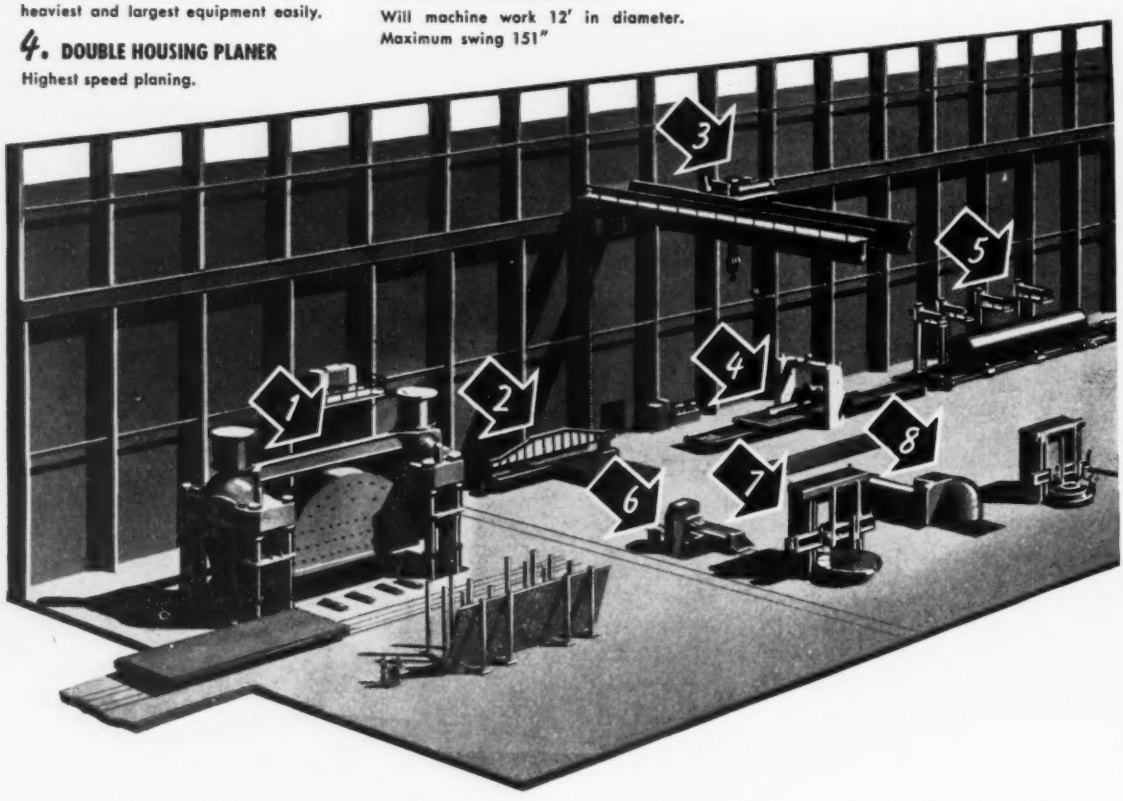
5. AUTOMATIC WELDING MACHINES
Submerged-arc, automatic flux recovery-type, mounted on track.

6. 500 TON CRIMPING PRESS
For cold-bending edge of plate preparatory to rolling.

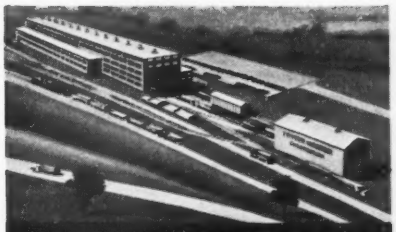
7. VERTICAL BORING MILL
Will machine work 12' in diameter. Maximum swing 151"

8. BENDING ROLLS—PINCH TYPE
By hot or cold rolling will form cylinders for medium-pressure vessels.

9. HIGHEST SPEED DRILLS—RADIAL TYPE
These are mounted on ways and tracks, power positioned.



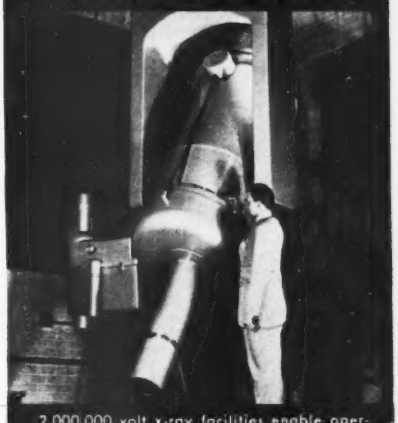
Mountain Top plant...



Artist's drawing of Foster Wheeler's new Mountain Top plant near Wilkes-Barre, Pa.

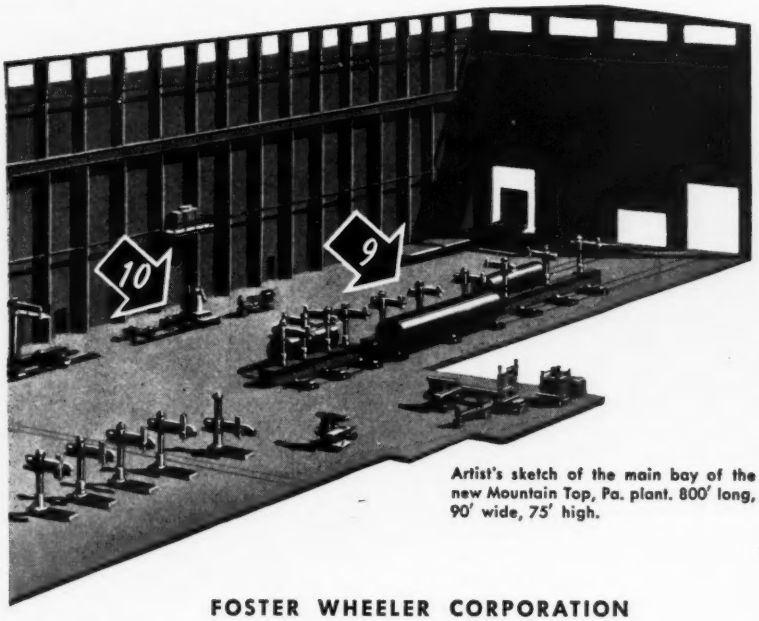
ANTICIPATING your requirements for more efficient central station, industrial and process components, Foster Wheeler has installed in this new plant, near Wilkes-Barre, Pa., the latest, most modern equipment, such as: the 8000-ton beam press, 2 million volt x-ray facilities, the newest developments in submerged arc-welding and high-speed drilling equipment, 83½ foot long stress-relieving furnace and others shown here.

This modern equipment, plus the plant's proximity to steel supplies, and its strategic location for direct rail shipment to all areas of the country, assure you of fast, economical, high-quality fabrication to meet your specifications for the largest and heaviest drums and pressure vessels.



2,000,000 volt x-ray facilities enable operators to see through 12 inches of steel.

10. **DRUM FACING MACHINE**
Quick preparation of ends of cylinder for assembly with heads.



Artist's sketch of the main bay of the new Mountain Top, Pa. plant. 800′ long, 90′ wide, 75′ high.

Stress relieving furnace permits annealing of fabricated parts more than 83 ft. long.

Shot blast building is equipped for surface cleaning by latest practice.

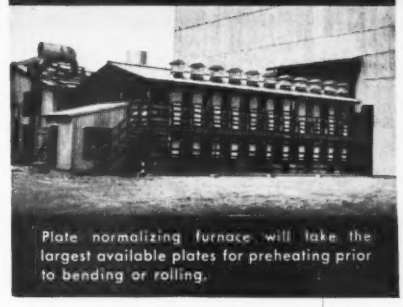


Plate normalizing furnace will take the largest available plates for preheating prior to bending or rolling.

FOSTER WHEELER CORPORATION
Designers and Constructors of
Stationary and Marine Steam Generators and Condensers
Process Equipment • Chemical and Petroleum Plants
NEW YORK • LONDON • PARIS • ST. CATHERINES, ONTARIO

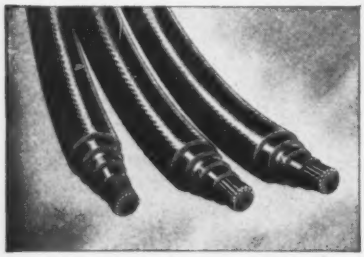
FOSTER WHEELER

WIRE AND CABLE INFORMATION DIGEST

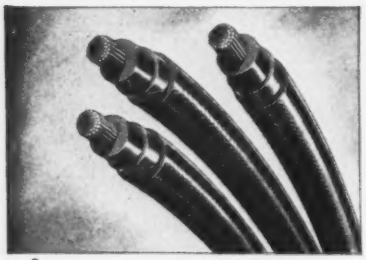
Fast way to wire new or old plants

How much extra current can AVA cables carry?

If you're planning new distribution, or changes in your existing wiring system, it will pay you to look into the savings of G-E Deltabeston* AVA cable. Deltabeston can actually offer as much as 64% more current from your present raceways—can offer more current in most wire sizes. For example:



These 500 MCM Deltabeston AVA cables carry 470 amperes—150 amperes more than standard 60 C cables of the same size. This can mean more current from your present conduit—extra current from every pound of copper.



These standard 500 MCM 60 C cables carry 320 amperes—32% less current than the same size G-E Deltabeston AVA cables. Deltabeston cables permit operation at increased temperatures—offer more current per pound of copper.

Famous G-E No. 1799 varnished cambric and double-asbestos insulation make Deltabeston suitable for operation at high temperature. That's why at normal ambient temperatures it can handle more current than ordinary types.

Registered Trade-mark General Electric Company

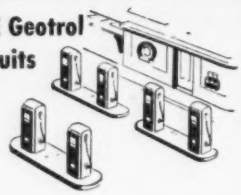
The Ford Motor Company rewired a plant, saved money, and maintained production by using the G-E No. 1799 varnished-cambric-insulated interlocked armor cable system.

It's quite a feat to rewire a plant in a hurry, keep costs in line, and maintain production at the same time. But the Ford Motor Company did just this in their Canton, Ohio plant by using General Electric's No. 1799 varnished-cambric-insulated interlocked armor cable system. All cables were 3-conductor, 500,000 CM for 15 kv service.

Installation speed—The ease and speed with which this interlocked armor cable system can be installed lowers cost. The cable can be laid quickly—indoors or outdoors—in long lengths, around corners, on low-cost aluminum racks. Engineering time is cut. Threading or bending of conduit is eliminated. Splices are of a simple mechanical type. Ford saved months, not days, because of these features.

Permanent—To our knowledge, no installation of interlocked armor cable has ever suffered mechanical damage sufficient to cause electrical failure. It is versatile as well as permanent and makes a neat, clean-looking installation. Booklet, *Interlocked Armor Cable,* describes the system in detail.

Check on G-E Geotrol wire for circuits exposed to gasoline



Where gasoline, or gasoline vapors are present, considerable time and expense can be saved by using G-E Geotrol wire. This U. L. listed wire eliminates the need for bulky, expensive lead-sheathed cable. Because G-E Geotrol wire is easy-to-handle and available in colors it is an excellent choice for wiring gasoline pumps, and for control and similar circuits in refineries.

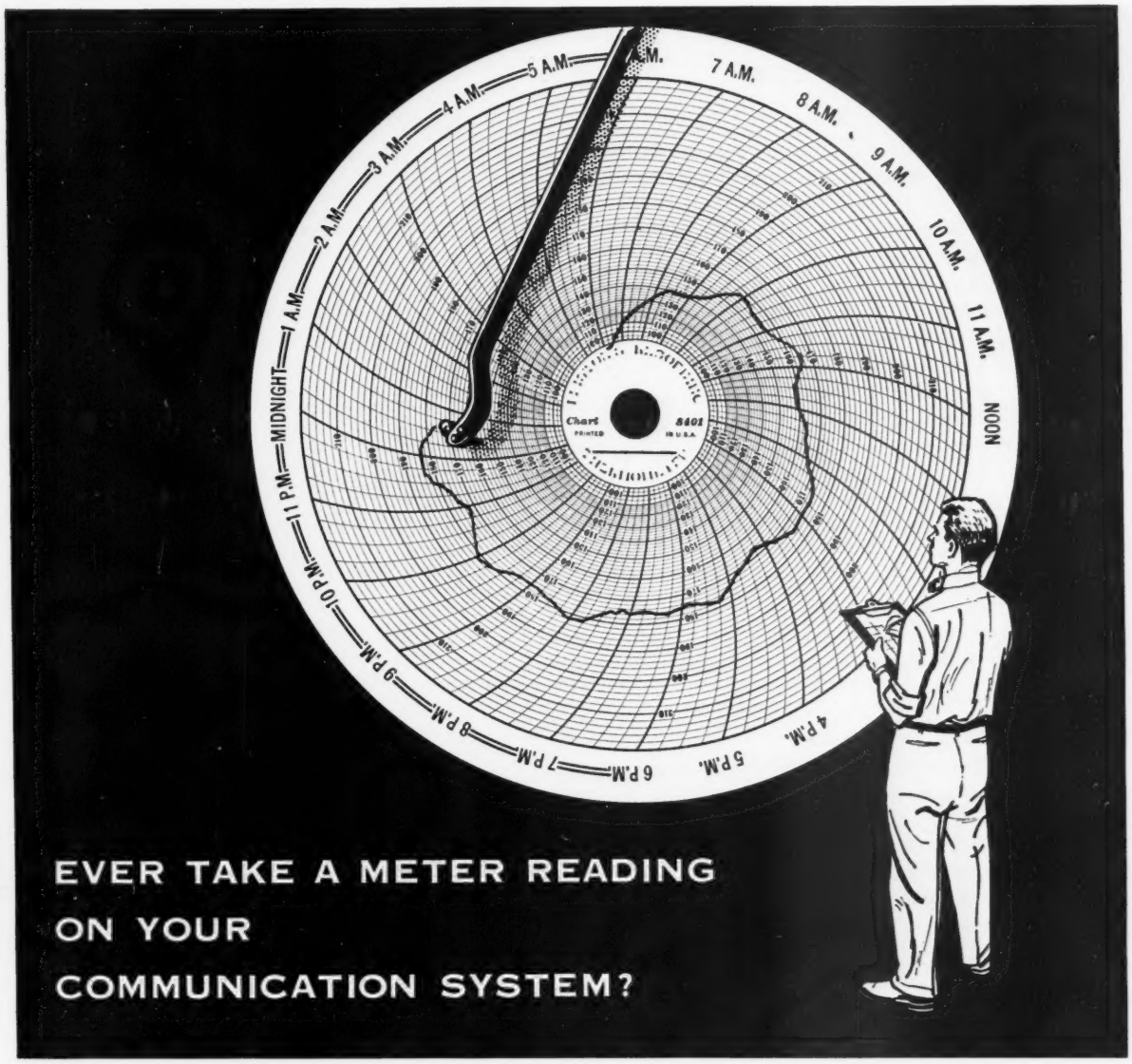
New Useful Booklet

This new, free booklet tells uses and advantages of General Electric's Super Coronol*-Geoprene nonmetallic power cable—for circuits to 15,000 volts. Men who work with high-voltage cable will find this booklet packed with data that can be put to daily use. Write for your copy.

The next time you have a question on cable or want any of the booklets mentioned in this advertisement, call a G-E wire and cable specialist for expert help. You can reach him at the nearest G-E Construction Materials district office. Or, write Section W91-1227, Construction Materials Division, General Electric Company, Bridgeport 2, Conn.

You can put your confidence in—

GENERAL ELECTRIC



EVER TAKE A METER READING ON YOUR COMMUNICATION SYSTEM?

Bell System communication engineers will help you take a good, close look at your communication system . . . *at no cost to you.*

Your Bell Telephone Company will make a comprehensive survey to help you get the best use of your facilities . . . local exchange, long distance, mobile, teletypewriter, metering and supervisory control . . . all the communications you use. More than one hundred studies are now underway for major pipe lines, power companies and railroads.

These surveys include recommendations to give your operation the best communications at the lowest possible costs. Many companies have changed, rearranged or added services on the basis of these surveys.

• If you are interested in a communication survey by Bell System experts without charge, call your local Bell Telephone representative now.

PRIVATE-LINE TELEPHONE

TELETYPEWRITER

MOBILE TELEPHONE

METERING CHANNELS

BELL TELEPHONE SYSTEM

Service . . . where and when you want it

PROMPT, experienced service is one of the most important plus values you get when you buy Honeywell instruments. An unequalled organization of trained specialists is always at your call at more than 110 offices in the United States and Canada. Offices are located in practically every large industrial city of the country . . . close to every major production center.

Trained Personnel

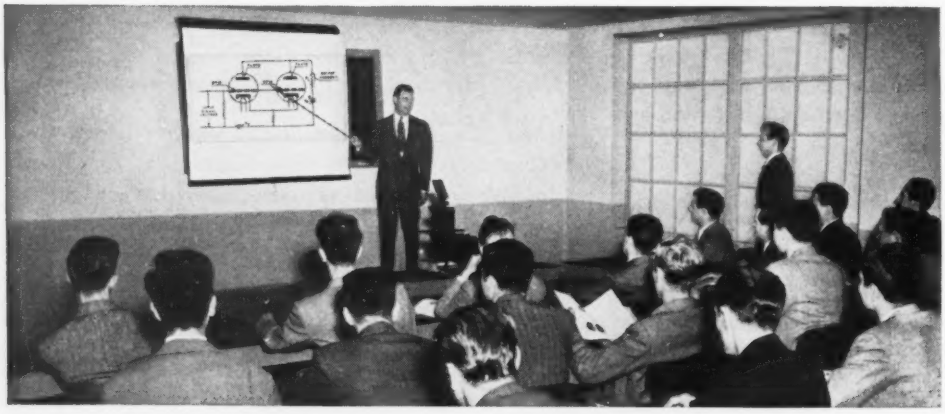
Honeywell service men are schooled not only in the theory of measurement and control, but also in the practical art of keeping good instruments in the best condition. Hand picked men begin this instrument education in an intensive training program in Honeywell factories. After graduation, they serve an apprenticeship in the field offices . . . while they learn still more about instrument maintenance from first-hand contact with plant problems. By the time a Honeywell man arrives at your plant on a call, he's a finished product worthy of the responsibility he bears, and capable of doing the kind of service job that you need . . . and that your Honeywell instruments deserve.

When trouble strikes, a wire or telephone call will bring a service man to your plant . . . often within a few hours. This assurance of prompt action means a lot to your production schedules. You'll never be left out on a limb because of delays in instrument maintenance.

Periodic Service Plan

But why wait for emergencies? Preventive medicine works on instruments, too. And the prescription is simple . . . a Periodic Service Contract, which brings a Honeywell service man to your plant at regular intervals to inspect, clean and adjust any Honeywell instruments you have. The plan is economical . . . can save you many hours of lost production time. Your nearest Honeywell office will be glad to give you full details.

For accurate *depend on*



TRAINED TO SERVE: *In Honeywell's service school, students get a thorough grounding in instrument theory and practice. After graduation, they become part of the most extensive organization of its kind in the world . . . ready to serve you competently and promptly, whenever and wherever you need them.*

facts on electrical loads—
ElectroniK recorders

FOR RECORDING generator output, station generation, tie line interchange or system totals, *ElectroniK* recorders meet every specification:

They're accurate: "Continuous Balance" system measures *every* load change with peak precision, by means of all-electronic, non-cyclic balancing.

They're fast: keep pace with the most rapid load variations.

They're extra-readable: 11-inch wide chart and scale spread load data out in full, legible detail.

They're versatile: supplied in any desired kilowatt or megawatt range; operate with a thermal converter connected to standard instrument transformers. Adding a phasing transformer adapts them to measurement of reactive power.

They're dependable: like the thousands of *ElectroniK* instruments used throughout industry for temperature, pH, flow, and scores of other measurements, *ElectroniK* power recorders have exceptionally few moving parts . . . no delicate mechanical linkages . . . utilize rugged, life-tested components.

Your local Honeywell engineering representative will be glad to discuss your power-measuring problem. Call him today—he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4568 Wayne Ave., Philadelphia 44, Pa.

● **REFERENCE DATA: Write for Data Sheet No. 9.1-3 . . . and for Catalog 90-2, "Supervisory Instruments for Power Generation."**

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

H HONEYWELL

ADVERTISEMENT

A REPORT FROM THE LABORATORIES OF REMINGTON RAND ON

Electronic developments for business and science

Much of the popular talk about "giant brains" has actually obscured the work which electronic computing systems *are doing now* . . . to answer the pressing problems of business record keeping and control as well as scientific and mathematical computations.

An electronic computer system can process a large volume of data faster and more economically than any other method. Only one operation is required for a complicated program of computing, selecting and filing information. Routine decisions can be made automatically on the basis of instructions given the system. Exceptional conditions requiring management attention can be automatically signaled.

Remington Rand presents here some practical electronic devices which may be applied profitably today by business and science:

High-speed tallying

This electronic storage system is a new Remington Rand development. For John Plain & Co., a large wholesale mail order firm, it produces up-to-the-minute inventory analysis by item under the most demanding conditions of seasonal and shifting demand. Just ten order clerks—working 10-key input systems to a magnetic drum memory—can provide accurate tallies of orders for 12,000 different items; make available complete tallies each day or anytime needed; and accommodate approximately 80,000 order lines per day.

Punched-card computers

New standards of speed and simplicity in punched-card procedures have been set by our new Punched-Card Electronic Computer. This system eliminates many time-consuming operations on other machines . . . produces *complete* cards which are ready for *immediate* tabulation of records and reports.

Big electronic computers

Remington Rand offers two distinct families of computing systems: 1) UNIVAC all-purpose system, designed primarily for business record keeping; 2) ERA 1101, 1102 and 1103 general purpose systems, designed for scientific or mathematical computations.

Solving problems *today!*

Right now, electronic systems are working economically on such practical tasks as – billing and accounting, statistical reports and forecasts, planning studies and scheduling, production and inventory control, payroll and cost accounting records, pricing analyses, engineering design and many data-reduction applications.

Outstanding UNIVAC features are: processing of alphabetical as well as numerical data without special coding and decoding operations; high speed in sorting, collating, and filing as well as computing and decision making; tremendous speed of input and output by magnetic tapes; and built-in circuits for *automatic self-checking*, unique in large-scale data-handling systems.

ERA systems have an enviable record for high speed solutions to complex mathematical problems such as data reduction, systems simulation, planning studies, and control in real time. The new ERA 1103 provides very high internal speed, large storage capacity, and flexibility to surpass other systems of the same character. It also provides versatility of input and output – by teletype tape, magnetic tape, punched cards (80 or 90 columns), line printer, electric typewriter, and oscilloscope.

Custom-made systems

Air traffic control is just one example of the many special purpose electronic-computer systems created by Remington Rand. This high-speed system receives via teletype such flight facts as: departure time, destination, route, fuel load, payload, and other pertinent data. In less than half a second, the system electronically compares the facts on each flight with as many as 2,000 flight plans it has stored in its magnetic-drum memory. It then revises, cancels, or brings the information up to date according to current conditions. The system completes the process by teletyping the required results back to the sending station . . . without human handling.

System designing

Remington Rand specialists analyze *your* needs in scheduling, process control, machine control, inventory control, data reduction, automatic filing, or other problems. A system may be created for you from standardized "building block" components, or we can design and make special components to your needs.

Computing services

Through two electronic-computing centers, Remington Rand offers you the advantages of the UNIVAC and the ERA systems on a service-bureau basis. The centers have solved problems of such diverse types as complex accounting and record keeping, involved statistical and personnel studies, and cross-indexing of complex catalogs, books, and timetables.

One of the recent jobs handled by the UNIVAC center was a study of seasonal sales patterns and advertising timing. The Bureau of Advertising wanted a projection of 1954 monthly buying trends for 28 specific lines of merchandise in stores across the nation. To do the calculations on this series of 336 trend lines with desk calculators would have taken about 200 man-hours. The UNIVAC computer made all the calculations in just 3 and ½ minutes.

Let us show you how to save time and money on one-time jobs, deadline jobs, unusual jobs, even routine jobs.

Management seminars

Through seminars and training courses, Remington Rand will help you learn how to apply electronic methods to your needs. In this way your organization can determine the computer system needed—and the economic considerations involved, including choice between our rental or purchase plans. We will also train your employees to operate the system efficiently. For more information, write to Remington Rand Inc., Electronic Computer Dept., Room 1550, 315 Fourth Ave., New York 10.

NOW

Great New Line of FWD Trucks with MATH • MATIC DESIGN

A significant engineering achievement which puts the power where there's work to be done by properly proportioning weight and torque

FUNCTION-ALL STYLING for easy mounting of snow-plows, underbody blades, dump bodies and other equipment. Choice of crown or military-type fenders.

RIGI-TAPERED FRAME—25% stronger. Heat-treated alloy steel. Deep taper design *rigidizes* front end for mounting plows and other equipment, distributes load over entire frame.

REAR AXLE—30% stronger. Full-floating. Diameter increased from 1.812 to 2.000.

POWER PROPORTIONING CENTER DIFFERENTIAL—Not only power on *all* wheels, but properly proportioned power for maximum performance at minimum operating cost.

EASY-ACCESS HOOD—Removable side panels and "butterfly" hinged top sections permit instant access to engine, despite close-mounted auxiliary equipment.

TRUNION-MOUNTED RADIATOR—Floating construction, isolated from frame by rubber. Takes the tough shocks without cracking core, shell or hood.

VALVE-IN-HEAD ENGINES in all trucks —light weight, high power output. Diesel engines available for all models.

CUSHIONED ENGINE MOUNTINGS—"Fourmaster" and "Sixmaster" series engines are three-point rubber mounted; quieter, vibration-free.

12-VOLT ELECTRIC SYSTEM — Quick power-surge for cold weather starting; hotter spark; less loss of current under heavy lighting loads.

HEVI-DUTY STEERING GEAR and linkage assures positive control under roughest operating conditions. Power steering optional on all models.

COMFORT CAB—Lots of leg room. Picture-window visibility. Cab hood is three-point rubber mounted. Adjustable seat, of light, strong tubular frame construction. Tip-out instrument panel for easy access.

STIRRUP-ACTION CLUTCH & BRAKES—Power assisted brakes, hydraulically assisted clutch. Suspended design of both pedals for easier servicing . . . provides "stirrup" action for greater leverage.

POWER OPERATED CENTER DIFFERENTIAL LOCK—FWD Center Differential Lock manually controlled but power-actuated. Red dashboard light warns when lock is on.

FWD MATH-MATIC DESIGN for

GREATER ECONOMY*—30 to 37% more tire wear! GREATER PERFORMANCE*—40 to 82% more tractive ability! GREATER SAFETY*

Now, it's top truck performance at minimum operating cost, thanks to exclusive FWD Math-Matic Design, the most important advancement in 43 years of heavy-duty truck leadership. Now, it's an all new line of FWD "Fourmaster" and "Sixmaster" series trucks with the widest range of G.V.W.'s in the industry . . . plus many other big features to give you more service for your truck dollar.

THE FOUR WHEEL DRIVE AUTO CO.
CLINTONVILLE, WISCONSIN • Canadian Factory KITCHENER, ONTARIO

* TRUCK RESEARCH PROJECT conclusions. For detailed data on 7 years' research conducted by the University of Wisconsin's College of Engineering, write now for your *free* copy of "The Truck That Went to College."

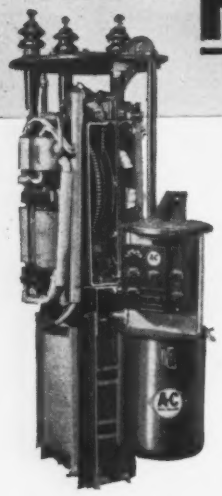
FWD

NOW... See your FWD dealer. He knows!

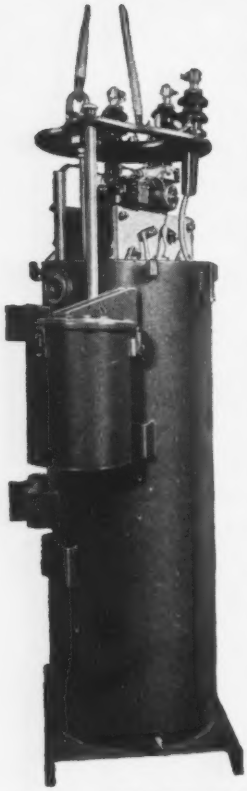
MATH • MATIC DESIGN

LOOK INSIDE

Get the FULL Profit Story



Look at Design. Real proof of quality comes only from a point-by-point comparison when you look inside a voltage regulator. Inside an Allis-Chalmers distribution regulator you'll find the reasons why you get ± 1 volt accuracy and 20% range of regulation over years and years of relatively trouble-free operation.



Look at Workmanship. Unit construction — an exclusive feature of A-C 5/8% step voltage regulators — is the reason why you get highest quality workmanship. Transformer, mechanism, control, cover and bushings are built as an integral unit. As a result, *all* connections can be made before tanking. And inspection can be accurate and thorough — thanks to such easy accessibility.

Then...Look at the Record.
Only from Allis-Chalmers do you get field experience that proves accuracy and reliability. A-C distribution regulators have been turning in profitable field records since 1944 — and they are based on a total of 20 years of 5/8% step regulator experience. It will pay you to get all the facts. Call the A-C district office nearest you or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4104

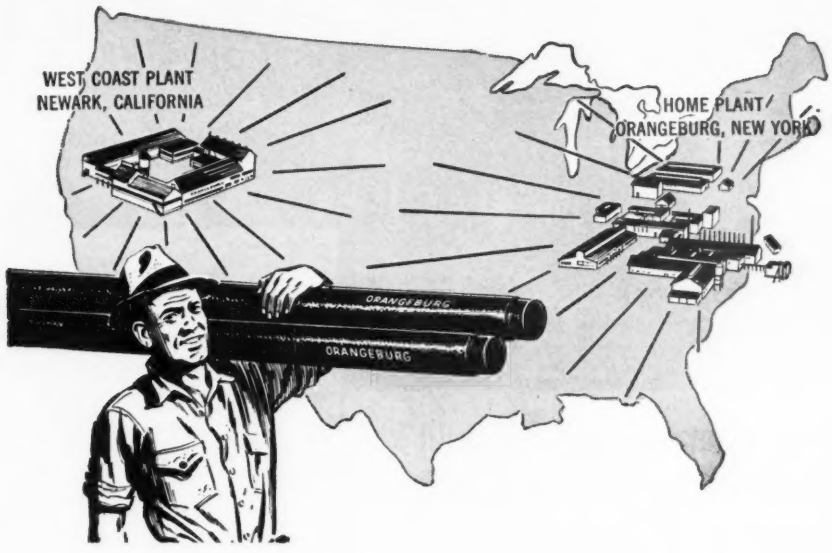
RATINGS AVAILABLE

7620 Volts—15, 50, 100 amp
5000 Volts—50, 100 amp
2500 Volts—100, 200 amp

ALLIS-CHALMERS

Originators of 5/8% Step Regulation

New West Coast Plant For Orangeburg Products



NEW PLANT WILL MEET THE GREAT DEMAND AND PROVIDE FAST SERVICE FOR WEST COAST CUSTOMERS

Public utilities, municipalities, contractors, and large industrial users will be glad to hear this good news about a new plant for Orangeburg Fibre Conduit on the West Coast. Design engineers have many reasons for specifying Orangeburg—the main objectives being longer cable life and lower installed costs. They count it good news that this time-tested and reliable protector of underground cables is in greater supply and can be had without delay. Send to Dept. EW-12 for Bend Section Folder, a money-saving idea that contributes additional economies.

ORANGEBURG MANUFACTURING CO., INC.
FACTORIES—ORANGEBURG, N. Y., and NEWARK, CALIF.

ORANGEBURG® FIBRE CONDUIT

STANDARD INSTALLED WITH CONCRETE

NOCRETE INSTALLED WITHOUT CONCRETE

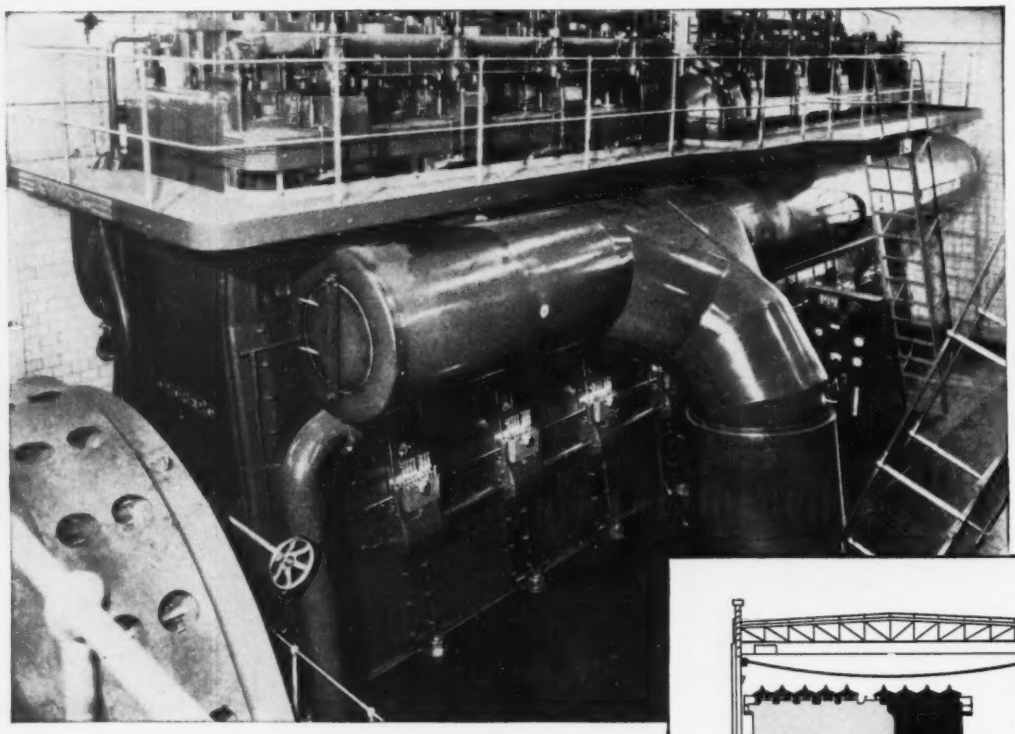
GraybaR ELECTRIC COMPANY

DISTRIBUTORS, ORANGEBURG FIBRE CONDUIT

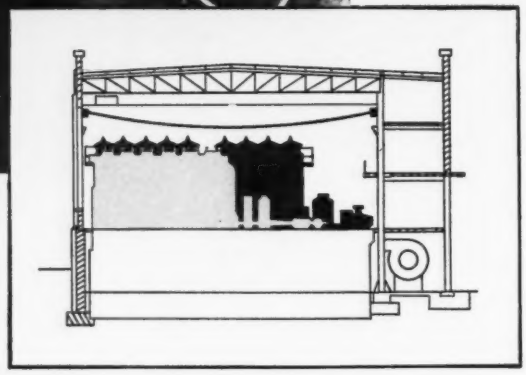
BRANCHES AND STOCKS IN PRINCIPAL CITIES

GENERAL ELECTRIC SUPPLY COMPANY

A DIVISION OF GENERAL ELECTRIC DISTRIBUTING CORPORATION



Shown here is the fourth large, heavy duty oil burning Nordberg 2-cycle Diesel to be installed in the Grand Haven plant . . . a 7000 hp, 5000 kw unit.



Outstanding economy and reliability of NORDBERG two-cycle DIESELS proved in 15 years of Municipal Power Expansion

Experience of the City of Grand Haven, Michigan, is evidence of the ability of Nordberg Diesel Engines to meet ever-increasing power requirements.

Starting over fifty years ago with a modest steam engine plant, Grand Haven has progressed through turbines, smaller internal combustion engines, and, in the last 15 year period, to the use of large Nordberg 2-cycle Diesels, ranging from 2250 to 7000 hp, as their main power supply. Their recent selection of a fifth Nordberg unit provides further proof of the outstanding reliability of these low speed, heavy duty engines.

It is important to note that the established economy of Nordberg Diesels is further enhanced in the Grand Haven plant through their ability to operate efficiently and economically on heavy, straight-run residual fuel oils. Operating records, covering over a year's operation show, for example, that the 7000 hp Nordberg Diesel has been producing power for an impressive 14.16 kwh/gal. of fuel.

This is another good example of the varied power problems being solved better, more economically with Nordberg Diesels.

MODERN DIESEL POWER GREATLY INCREASES PLANT CAPACITY

Not only has modern Diesel power brought excellent fuel economy to Grand Haven, but it has also given the plant six times as much power installed in a given building section.

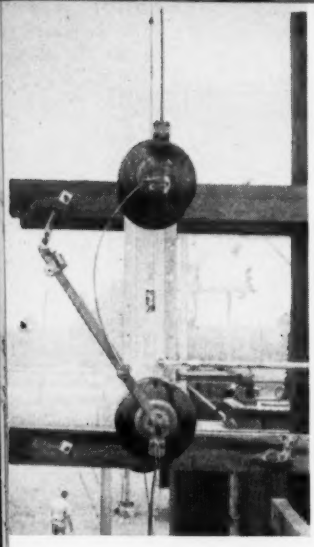
The expansion that provided room for the last Nordberg engine, a 7000 hp unit, is almost identical in area to that occupied by any one of the three original 1140 hp Diesel engines.

NORDBERG MFG. CO.
Milwaukee, Wisconsin

NORDBERG

DIESEL • DUAFUEL® AND SPARK-FIRED GAS ENGINES

P953

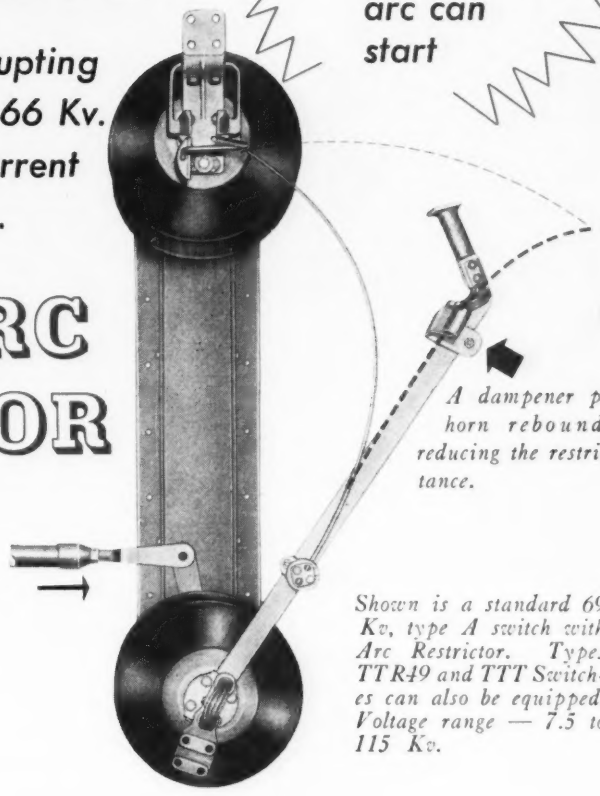


No arc visible

when interrupting 30 miles of 66 Kv. charging current with the . . .

SNAPS *before the arc can start*

R&IE ARC RESTRICTOR



A dampener prevents horn rebound from reducing the restrike distance.

Shown is a standard 69 Kv, type A switch with Arc Restrictor. Types TTR49 and TTT Switches can also be equipped. Voltage range — 7.5 to 115 Kv.

- *Start now to make real savings on 90% of your "live" switching operations*

Line Charging Current or Transformer Magnetizing Current can now be interrupted with amazing economy. A simple ARC RESTRICTOR can easily be furnished to new switches or quickly attached to switches already installed.

Reduce the mental and physical hazard to your operator. Eliminate those long, crackling arcs. Improve morale and efficiency.

Reduce the investment of more costly types of circuit interrupters. Eliminate costly maintenance. Switch to the Arc Restrictor and you'll switch safely.

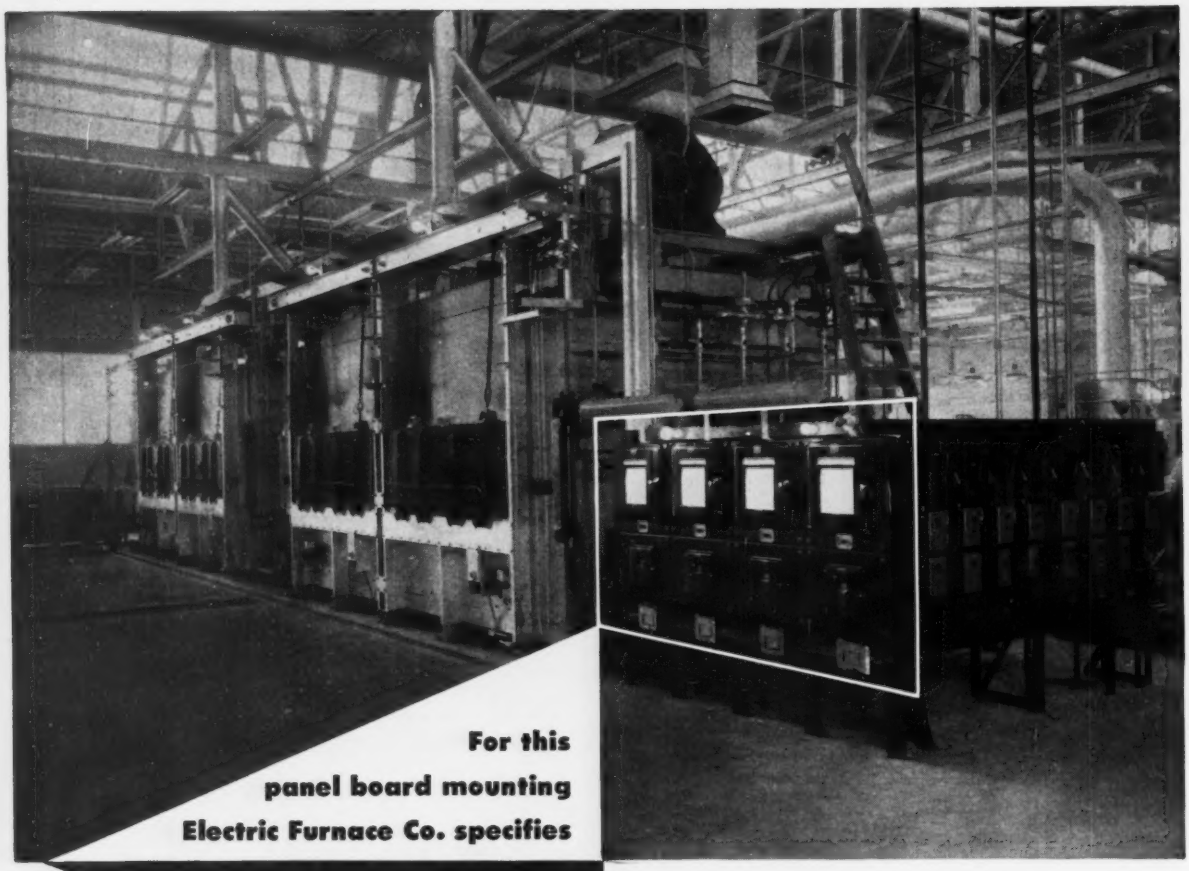
R&IE SWITCHING EQUIPMENT

DIVISION OF I-T-E CIRCUIT BREAKER CO.

Greensburg, Pa.

STRUCTURES—steel or aluminum • TESTING DEVICES • KIRK KEY INTERLOCK SYSTEMS • ISOLATED PHASE BUS STRUCTURES • INTERRUPTER SWITCHES

INDOOR BUS SUPPORTS and BUS FABRICATION • OUTDOOR BUS SUPPORTS and AIR SWITCHES • SUBSTATION



For this panel board mounting Electric Furnace Co. specifies

K&M Ebonized Asbestos

The above illustration features two EF gas fired double ended recirculating draw furnaces for treating aircraft engine parts, manufactured by the Electric Furnace Company, Salem, Ohio. K & M Ebonized Asbestos is well suited for the control panels, because of its high resistance to severe shocks, vibration, rapid temperature change and its exceptionally high dielectric strength.

For switchboards, bus bar supports, cabinets, compartment linings, bench boards, testing tables, and such—it is ideal. It is made in thicknesses from ⅛″ to 4″, giving it a wide range of usefulness.

Perhaps this time-tried product can help solve one of *your* design problems! Write us for complete specifications on K & M Ebonized Asbestos, or for answers to questions about particular applications.

KEASBEY & MATTISON COMPANY • AMBLER • PENNSYLVANIA
IN CANADA: ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG, VANCOUVER

Nature made asbestos...
Keasbey & Mattison has made it serve mankind since 1873

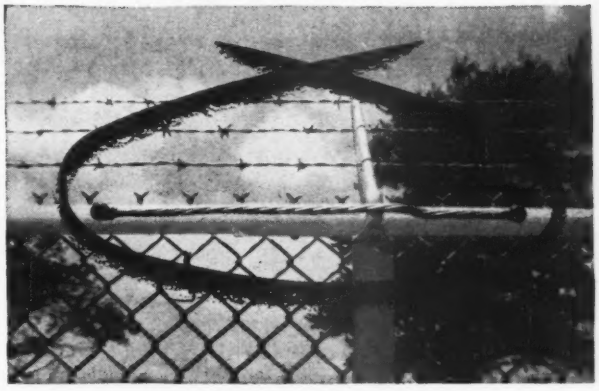
CADWELD

BUSBAR ⅛" x1"—½" x 8"

Design and field electrical engineers rate CADWELD the finest electrical connection on the market. Here are the reasons WHY!!!

1. **CADWELD connections have more current carrying capacity than the conductor itself.**
2. **CADWELD connections cannot loosen or corrode.**
3. **Any shape or size conductor (copper or steel) can be CADWELDED with standard equipment.**
4. **Single CADWELD cartridges or combinations can be used for all size connections.**
5. **Equipment is portable — perfect for field use—no outside source of power or heat required.**

For the best in
ELECTRICAL CONNECTIONS



CABLE TO STEEL ALL SIZES
CABLE #6—3,000 MCM

The Current Trend
IS
CADWELD
ERICO PRODUCTS, INC.
2070 E. 61st PLACE CLEVELAND 3, OHIO

ERICO PRODUCTS, INC.
2070 E. 61 St. PLACE CLEVELAND 3, OHIO

☐ Send Descriptive Literature on CADWELD Electrical Connections

☐ Have Representative Call

NAME _____ POSITION _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Greetings

Our Sincere Good Wishes
for a Merry Christmas and a Prosperous New Year

F. A. Rose—Mgr. of Mfg.

Fred

G. M. Ruoff—V-Pres. Gen. Mgr.

Rudy

F. E. Pope—Sales Mgr.

Frosty

D. A. Crytzer—Sales Eng.

Dan

T. R. Fry—Chief Eng.

Tom

H. L. Elliott—Field Eng.

Harold

As the old year passes—we pause to express our warm appreciation for the increased confidence you have placed in us. In this confidence there is trust. Your trust in us gives us the will to reach even greater goals. We pledge our best efforts to continue to serve you well in 1954.

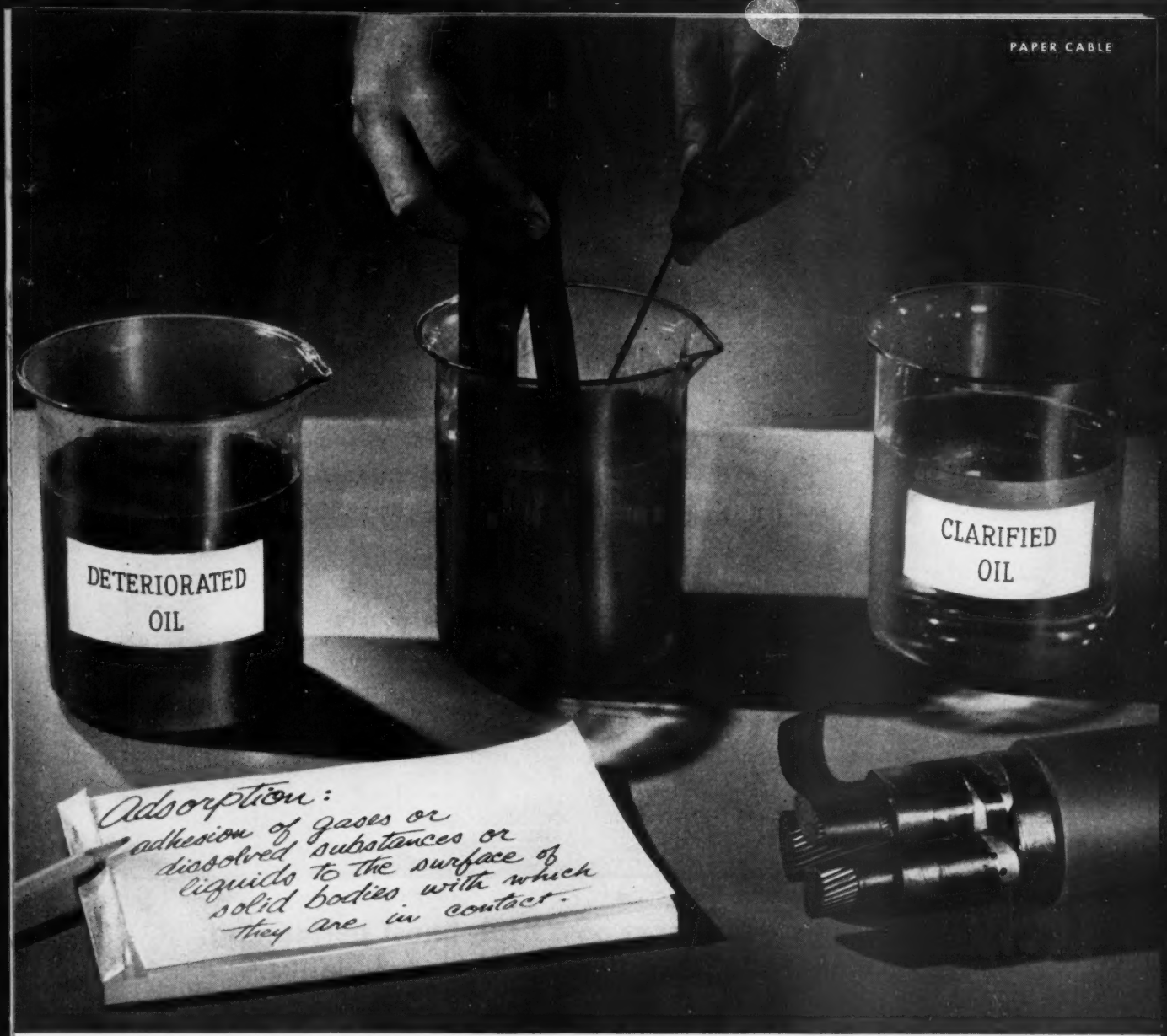
PP INC.

Porcelain Products, Inc.

PARKERSBURG, W. VA.

Your INDEPENDENT Insulator Manufacturer

EXPORT REPRESENTATIVE: Philips Export Corp., 100 E. 42nd St., New York 17, N. Y., U. S. A. Cable Address: "PHILYORK"


DETERIORATED OIL
CLARIFIED OIL
Adsorption:
adhesion of gases or dissolved substances or liquids to the surface of solid bodies with which they are in contact.

EXPERIMENT in adsorption: add tapes made with colloidal carbon to deteriorated oil; stir. Note that Carbon Black *adsorbs* impurities. Clear oil results. In Type CB Cable these carbon-black tapes purify oil by the same process.

"Black Magic" makes this cable last longer

Heat and electrical stress . . . heat and electrical stress . . . keep it up long enough and insulating oil in ordinary paper cable breaks down. The cable may have to be replaced.

ANACONDA Type CB* (Carbon Black) Power Cable is different. Special carbon-black tapes continually purify and stabilize the insulating oil . . . keep oxidation products outside the dielectric field. They stop ionization discharges. "Black magic" insures added life for this superior cable.

For greatly extended sheath life of ANACONDA Type CB Cable, specify ANACONDA F-3** alloy. This superior alloy-lead sheath won't age-harden . . . resists slow-bending fatigue, creep, burst and abrasion. Cable joint sleeves also are available in this same alloy. They all offer higher tensile strength, a 50% higher bursting strength than copper-lead, lower creep rate and similar increased resistance to bending fatigue and vibration.

Ask your Anaconda Representative to show you how this outstanding cable can help give your distribution system maximum service life and economy. *Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.* 53332

*CB — Carbon Black (U. S. Patents 2,102,129, 2,405,853) Reg. U. S. Pat. Off.
**F-3—Arsenic-Lead Alloy (U. S. Patents 2,300,788, 2,375,755, 2,504,600 and 2,570,501) Reg. U. S. Pat. Off.

ANACONDA®

Service and overhead distribution cables, bare and weatherproof, including ACSR • signal, control and communication cable • portable cords and cables • network cables • airport and series lighting cables • mine cables • magnet wire • copper, aluminum and copperweld conductors • wire and cable accessories.

NOW!

NEW 1954 CHEVROLET TRUCKS

Completely new—the most powerful, finest performing, best-looking Advance-Design trucks ever built!

Here's America's greatest truck builder's latest and greatest truck! Here's the brand-new line of Chevrolet Advance-Design trucks for 1954!

You'll find they're packed with great new features . . . loaded with big new advantages that mean faster, more efficient service and lower operating costs on *your* job.

NEW POWER AND ECONOMY

You get new high-compression power and greater operating economy with *three* advanced valve-in-head engines. Bigger, brawnier "Thriftmaster 235" engine. Rugged, durable "Loadmaster 235" engine. Mighty, all-new "Jobmaster 261" engine*—most powerful in Chevrolet truck history.

Most trustworthy trucks on any job!

CHEVROLET

ADVANCE-DESIGN TRUCKS

NEW RUGGEDNESS AND RELIABILITY

Heavier axle shafts on 2-ton models. Bigger, more durable clutches on light- and heavy-duty models. Stronger, more rigid frames on *all* models. New pickup and stake bodies are built to stand the roughest going and to keep coming back for more—and they give you greater load space for '54!

NEW COMFORT AND CONVENIENCE

New Comfortmaster cab provides increased visibility with new one-piece curved windshield. New Ride Control Seat* brings you extra driver comfort. New truck Hydra-Matic transmission* offers the last word in no-shift driving ease. Available not only on ½- and ¾-ton Chevrolet trucks, but on 1-ton models, too!

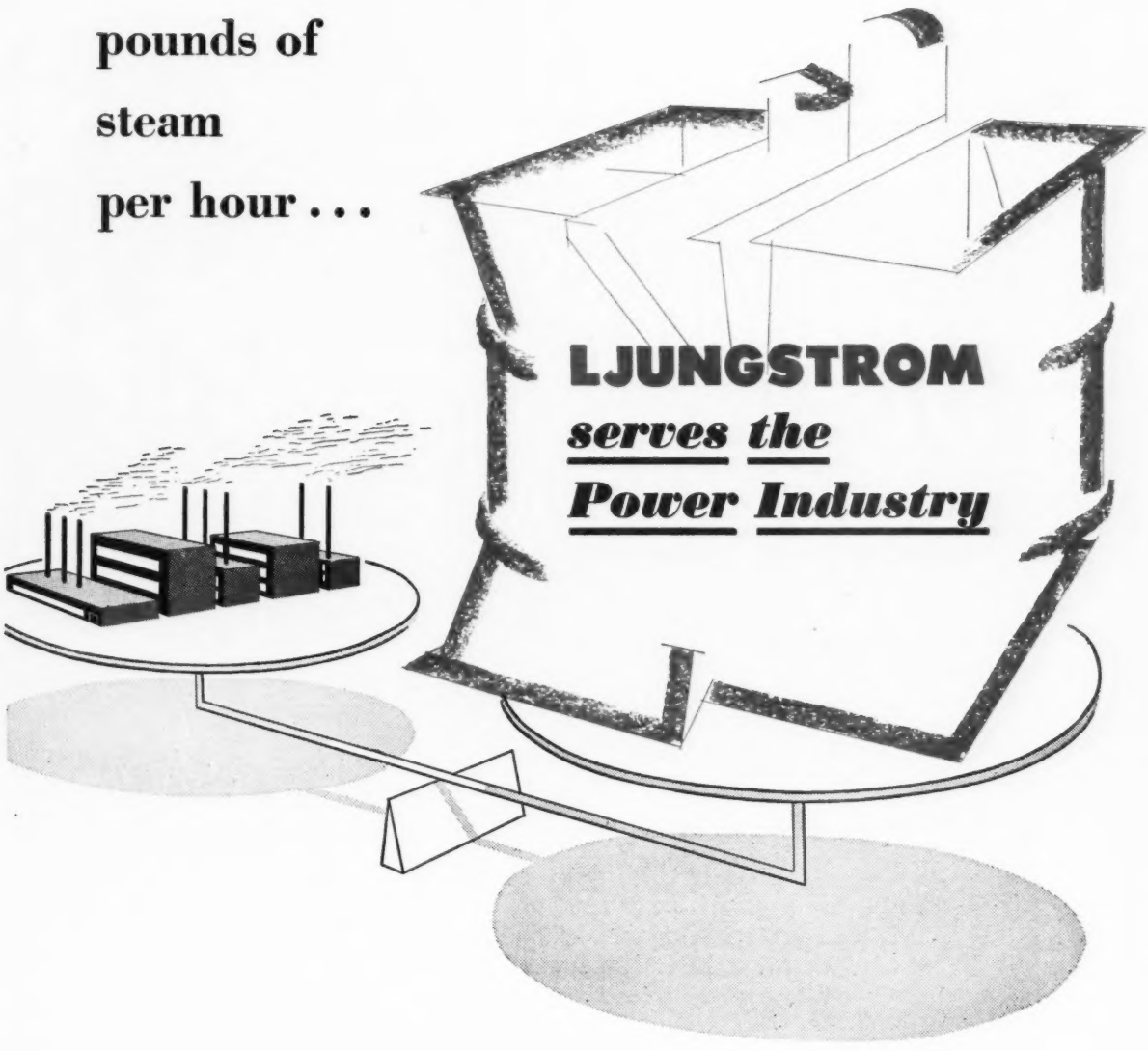
Plan to see the completely new '54 Chevrolet trucks, and get the whole money-saving story at your Chevrolet dealer's now. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

**Optional at extra cost. Ride Control Seat is standard on C.O.E. models, available on all other cab models as extra equipment. Rear corner windows in standard cab, optional at extra cost.*

MORE CHEVROLET TRUCKS IN USE THAN ANY OTHER MAKE

347,000,000

pounds of steam per hour . . .



In the post-war rush to expand power generating facilities, utilities have not lost sight of the need for *operating economy*. Increasingly over these years, the fuel-saving, performance-improving potentials of the Ljungstrom Air Preheater have been realized – until today, nearly two out of every three power boilers are ordered with the specification "Ljungstom Air Preheater."

Since 1946 alone, in fact, more than 347,000,000 pounds per hour of steam capacity – installed or on order – have been designed for Ljungstrom.

This record speaks for itself. It proves that the Ljungstrom Air Preheater is, indeed, *the most economical heating surface in the modern boiler.*

The AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.

Nicopress

SUSPENSION DEAD END

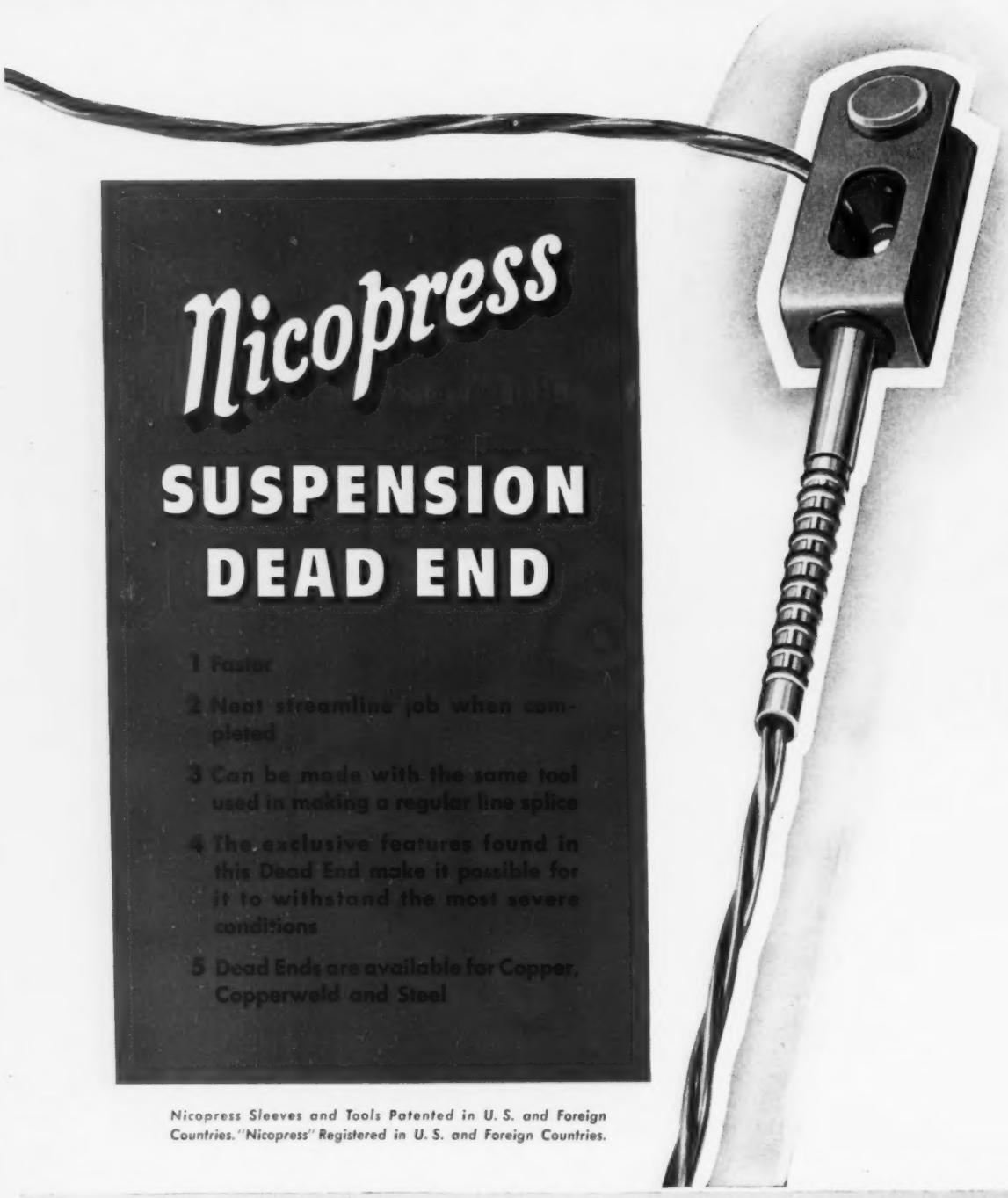
1 Faster

2 Neat streamline job when completed

3 Can be made with the same tool used in making a regular line splice

4 The exclusive features found in this Dead End make it possible for it to withstand the most severe conditions

5 Dead Ends are available for Copper, Copperweld and Steel



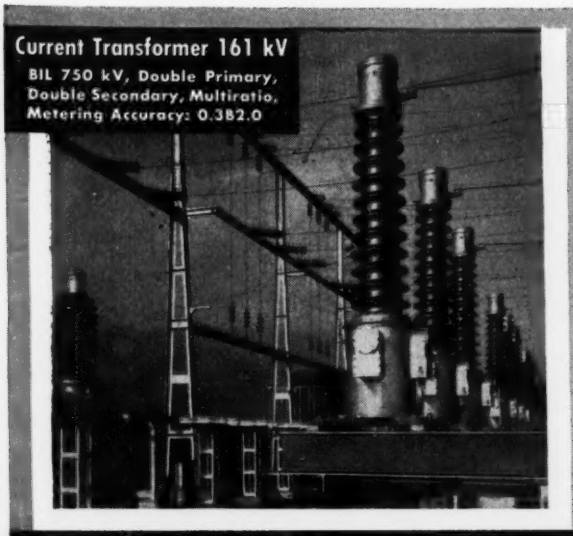
Nicopress Sleeves and Tools Patented in U. S. and Foreign Countries. "Nicopress" Registered in U. S. and Foreign Countries.

The National Telephone Supply Company

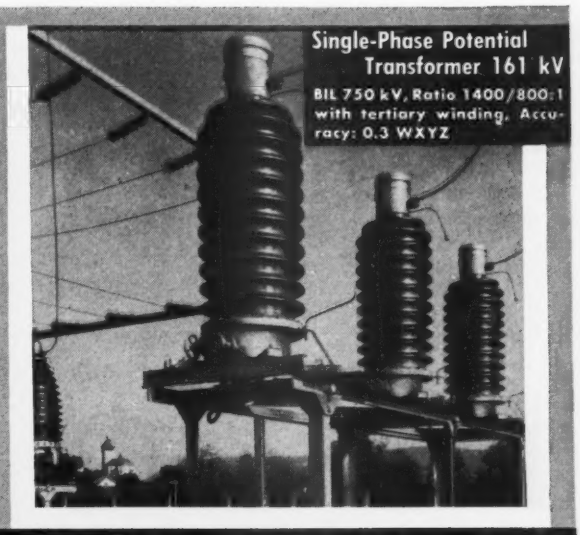
5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr.: N. SLATER CO., LTD., HAMILTON, ONTARIO, CANADA

Export Distributor: INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.



Current Transformer 161 kV
BIL 750 kV, Double Primary, Double Secondary, Multiratio, Metering Accuracy: 0.3B2.0



Single-Phase Potential Transformer 161 kV
BIL 750 kV, Ratio 1400/800:1 with tertiary winding, Accuracy: 0.3 WXYZ

light in COST . . . *light in* WEIGHT
. . . HEAVY on DEPENDABILITY

BROWN BOVERI

High Voltage, Insulator-type, Oil-Filled

INSTRUMENT TRANSFORMERS

built and tested to conform to prevailing ASA standards C57.13

Suitable for both revenue METERING and RELAYING, these Brown Boveri instrument transformers are available for outdoor service in all standard ASA voltage classes: 34.5 kV up to 440 kV.

The remarkably low prices of these current and potential transformers—particularly those at higher voltages, invites comparison by astute users. They discover that they can make substantial dollar savings while securing thoroughly dependable, *proven-in-the-field* reliability when they specify Brown Boveri.

CHECK ALL THESE ADVANTAGES:

1— They are priced for economy-minded, quality-conscious purchasers. Low cost is made possible by mass production of insulator type transformers used with the advanced-design Brown Boveri Air Blast Breakers.

2— Newly designed for extreme light weight and small size.

3— There are no erection costs at the job site since they are shipped from the factory completely assembled, filled with oil, tested, ready for installation.

4— They are designed for minimum maintenance.

5— No extra charges are made for non-preferred ASA primary current ratings of current transformers.

6— No extra charges for tertiary winding of potential transformers.

7— They are backed by the world-famous engineering and production background of Brown Boveri.

buy brown boveri . . . *it's better business!*

Write for data.

BROWN BOVERI

BROWN BOVERI CORPORATION

19 RECTOR STREET, NEW YORK 6, N. Y.

Georgia Power Company Plants use

Exide-Manchex

BATTERIES

PLANT YATES

PLANT MITCHELL

PLANT SINCLAIR DAM

PLANT McMANUS

Here are four generating plants of the Georgia Power Company that are equipped with Exide-Manchex batteries.

Plant Yates works twenty-four hours a day, seven days a week. Each of its three generators has a capacity of 100,000 kilowatts. Plant Mitchell has a possible total capacity of 125,000 kilowatts . . . the Sinclair Dam plant, located on the Oconee River, will produce 45,000 kilowatts . . . and Plant McManus is designed for ultimate expansion to four steam-electric generating units of 40,000 kilowatts each.

In addition, Georgia Power Company will soon complete a 300,000 kilowatt capacity steam-electric plant, Plant Hammond, on the Coosa River near Rome. A 60 FME-21 Exide-Manchex battery will be installed.

EXIDE-MANCHEX BATTERIES ARE PREFERRED BY MANY UTILITIES BECAUSE THEY ASSURE:

POSITIVE OPERATION: Dependable performance at ample voltage with no switchgear failures.

INSTANTANEOUS POWER: High rates for switchgear operation with adequate reserve power for all other control circuits and for emergency lighting.

LOW OPERATING COST: Extremely low internal resistance.

LOW MAINTENANCE COST: Water required about twice a year. No change of chemical solution during life of battery.

LOW DEPRECIATION: Sturdy, long-life construction.

GREATER CAPACITY in a given amount of space avoids overcrowding.

• • •

Various sizes and types of Exide Batteries are available in plastic containers.

Exide-Manchex is your best battery buy for all control and substation services.

1888 . . . DEPENDABLE BATTERIES FOR 65 YEARS . . . 1953

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 2 • *Exide Batteries of Canada, Limited, Toronto*

"EXIDE" and "MANCHEX" *Reg. T.M. U.S. Pat. Off.*

Which Square D Control Center will do *Your* job best?

1. STANDARD
2. BACK-TO-BACK
3. DUST-TIGHT
4. WEATHER-PROOF
5. FILTERED AIR

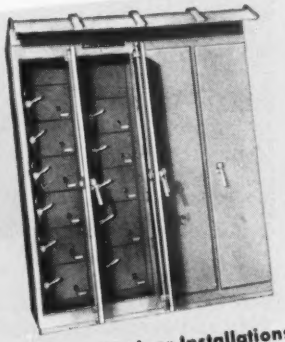
1 Standard Square D Plug-in Control Centers in Nema I enclosures are designed for the majority of installations.

SQUARE D FOR FLEXIBILITY! Square D's plug-in units can be removed, added, or exchanged at will. Both fusible switch and circuit breaker types available. Standardized sections and units are 100% re-usable after plant conversions or rearrangements.

Write for Bulletin 8938. Address Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin.

2 Space an Important Factor? Back-to-back Nema I enclosures provide maximum concentration of control in limited space.

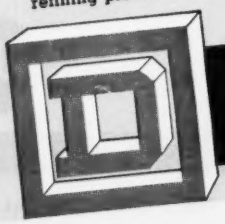
3 for Excessively Dusty Locations—felt-gasketed, dust-tight, Nema V enclosure. A "natural" for foundries, smelting and refining plants.



4 for Outdoor Installations—rubber-gasketed, Nema III enclosure protects equipment from weather. Special rust-proof, vinyl-clad finish.

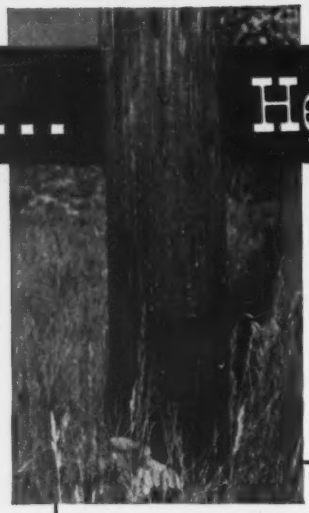
5 Need Filtered Air Protection? Built-in fan and filter combination pressurizes enclosure for moderately dusty or certain types of corrosive atmospheres.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS



SQUARE D COMPANY

1903 · 50 YEARS OF DESIGN LEADERSHIP · 1953

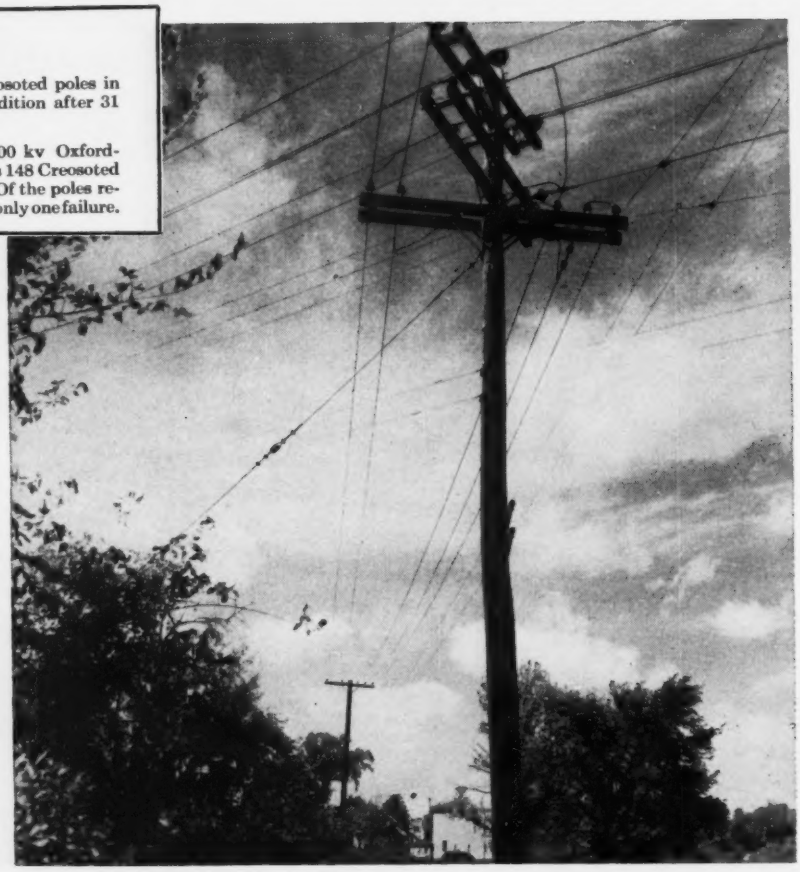


. . . Here's Proof of Performance

A MICHIGAN ELECTRIC COMPANY REPORTS: 425 CREOSOTED POLES INSTALLED IN 1922 . . . ONLY ONE REMOVED FOR DECAY

THIS CLOSE-UP of one of the Creosoted poles in the line shows its excellent condition after 31 years of service.

DETROIT EDISON COMPANY'S 24,000 kv Oxford-Romeo transmission line includes 148 Creosoted poles that were installed in 1922. Of the poles removed, decay was responsible for only one failure.



In 1922, Detroit Edison Company installed a 14-mile 24,000 kv transmission line between Oxford and Romeo, Mich., using 425 poles treated with Creosote. Thirty-one years later, 148 of the original poles are still in the line.

But of the 277 removed, *only one was taken out because of decay.* The others were removed because of road widening, residential and industrial construction, automobile accidents and storms. And many of the poles removed were reused in other locations.

In the Detroit Edison System—which has over 600,000 poles—nearly three-fourths are treated with Creosote. Their Supervising Engineer of Inspection and Standards points out, "Creosote is an excellent preservative with an enviable service record. It offers absolute reliability, great lasting power and adequate cleanliness for pole use."

The Creosoted poles are southern pine and cedar, and company officials say southern pine poles wouldn't last five years without Creosote, but they'll last 30 to 60 years with it.

Service records like this are important to you because they prove the time-tested effectiveness of Creosote as a wood preservative. Its toxicity and permanence have made it first choice among users of treated wood.

For the finest pole and crossarm performance always specify U·S·S Creosote, the uniform product of continuous processing in America's largest tar distillation plant. For complete information, contact our nearest Coal Chemical sales office or write directly to United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

U·S·S CREOSOTE

USS

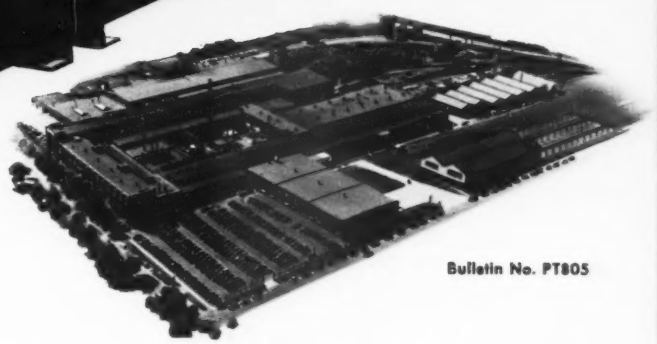
5-1682

UNITED STATES STEEL

POWER

TRANSFORMERS

MOLONEY ELECTRIC



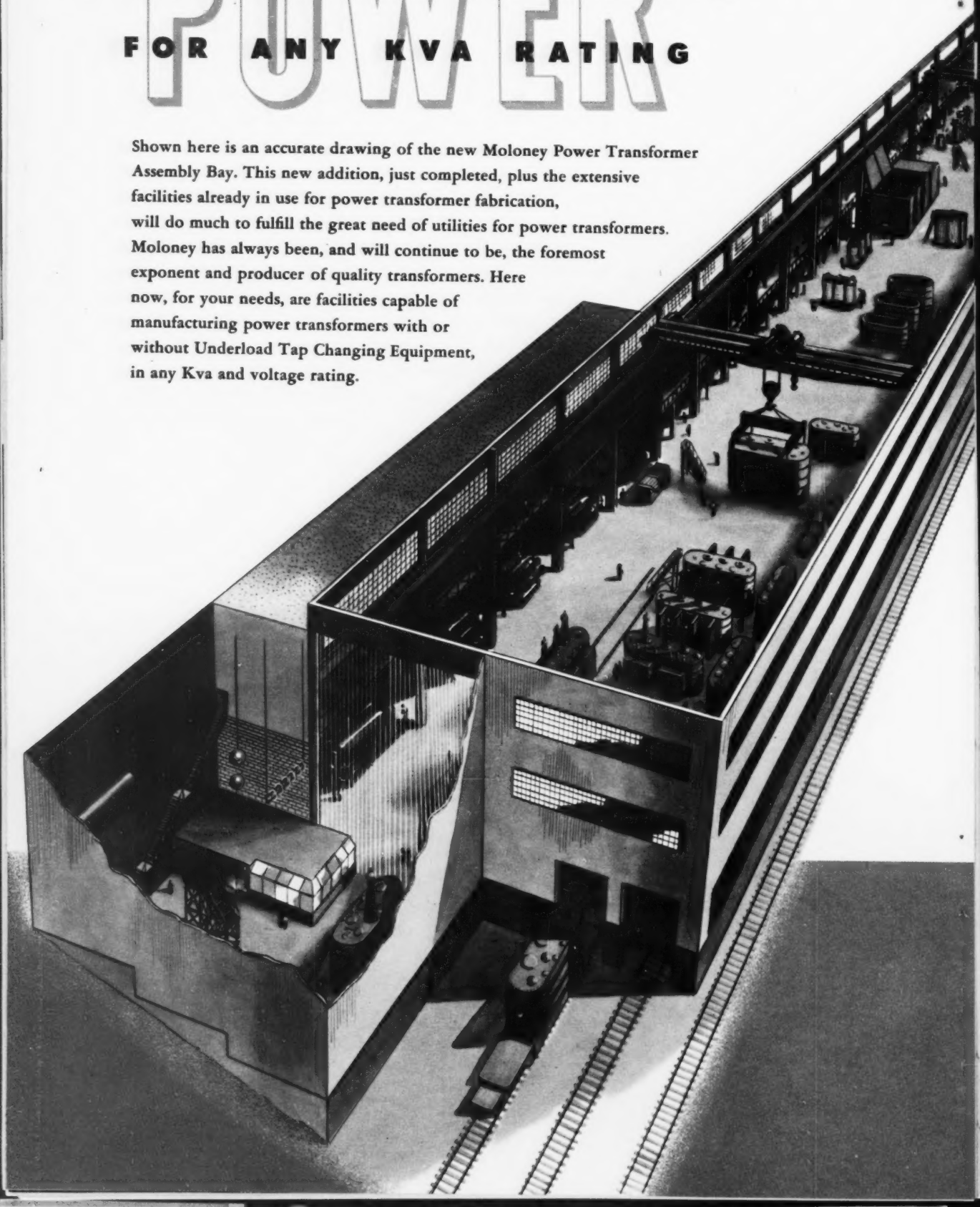
Bulletin No. PT805

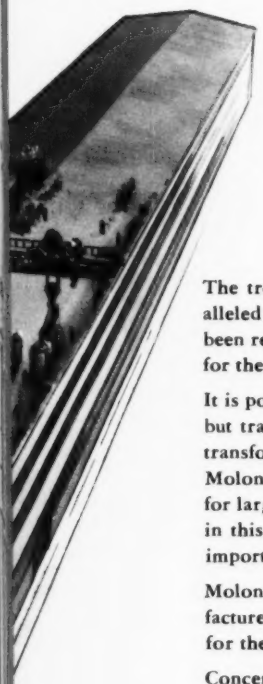
MOLONEY ELECTRIC COMPANY ST. LOUIS 20, MO.

POWER

TRANSFORMER FACILITIES FOR ANY KVA RATING

Shown here is an accurate drawing of the new Moloney Power Transformer Assembly Bay. This new addition, just completed, plus the extensive facilities already in use for power transformer fabrication, will do much to fulfill the great need of utilities for power transformers. Moloney has always been, and will continue to be, the foremost exponent and producer of quality transformers. Here now, for your needs, are facilities capable of manufacturing power transformers with or without Underload Tap Changing Equipment, in any Kva and voltage rating.





The trend toward higher system operating voltages has been paralleled by the use of larger Kva transformers. This trend has even been reflected in the increased rating of transformers being supplied for the lower transmission voltages.

It is possible to design and fabricate transformers of any Kva rating, but transportation limitations have influenced utility planning and transformer manufacture design. To overcome these size limitations Moloney has adopted the shielded concentric layer type of winding for large power transformers. The savings in critical space obtained in this manner are augmented by performance advantages of great importance to the utilities.

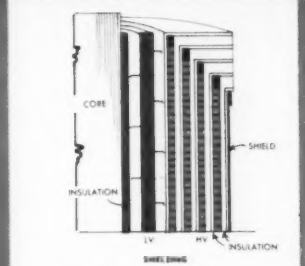
Moloney in planning the expansion of its facilities for the manufacture of these large Kva power transformers included equipment for the fabrication of concentric layer high voltage windings.

Concentric layer high voltage windings possess high inherent impulse strength due to the uniform distribution of impulse voltages over the several layers and can therefore be accurately designed and built to withstand the surge impulses encountered in normal system operation. Concentric layer windings have inherently high mechanical strength and therefore are capable of withstanding the distortion and breakdown caused by high short circuit currents.

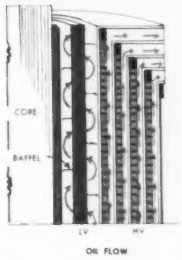
These inherent features of concentric layer windings prove its reliability in impulse and short circuit tests in order to provide uninterrupted service in the field.

Oil ducts in concentric layer windings are vertical, and are spaced throughout the winding to provide the most effective heat transfer. As a result they are ideally suited to both self-cooled and forced-oil-cooled transformers. Large size high voltage transformers are shipped upright in a one piece tank saving much time in unloading and assembly in the field.

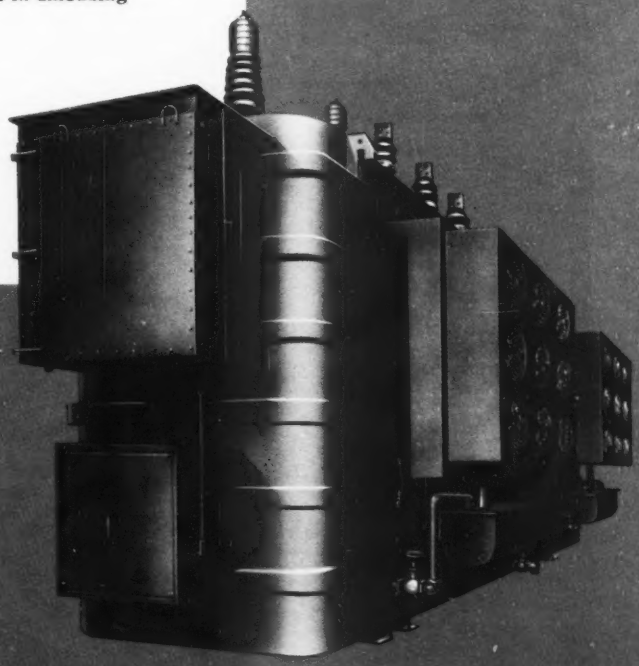
When transformer applications are such that Underload Tap Changing Equipment is advantageous to the installation, Moloney can design and supply such equipment as an integral part of the installation in any Kva and voltage rating.

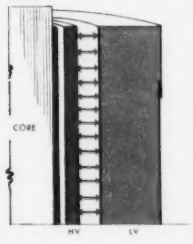


Shields are placed on the outside of the high voltage coils and provide greatly improved voltage distribution throughout the entire winding. Insulation is placed between winding and between layers. The proximity of insulation within the winding and the elimination of creepage paths in the direction of high electrical stresses provide superior dielectric strength.



High voltage concentric layer windings have axial ducts which permit unrestricted oil flow past each conductor. Oil flow is therefore directed through the winding itself to provide the most efficient heat transfer. In the low-voltage disk windings, directed "zig-zag" oil flow is used.





RADIAL FORCE

Since high voltage windings are wound about the same axis as the transformer low voltage windings, all mechanical forces are radial.

BETTER ALL ALONG THE LINE

For over half a century, the name Moloney has identified equipment designed and built to give better performance . . . and this has been proved by operating records of utilities everywhere.

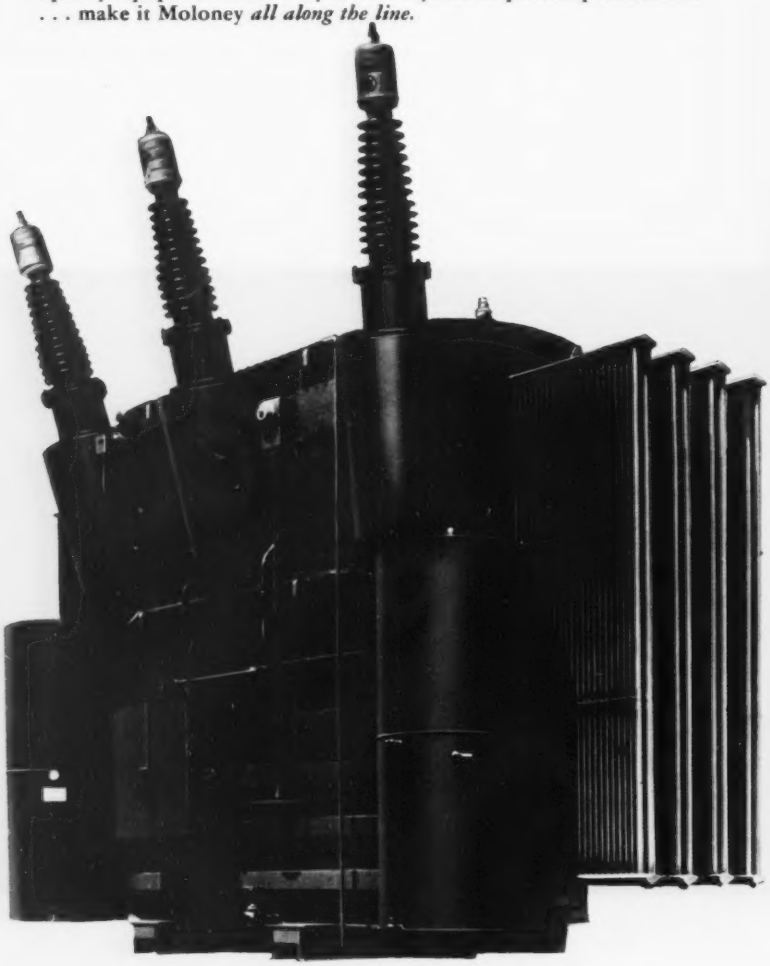
And these are realistic operating standards viewed in the overall dimensions of your power picture. It is a well-rounded approach expressed in Design, Development, Dependability.

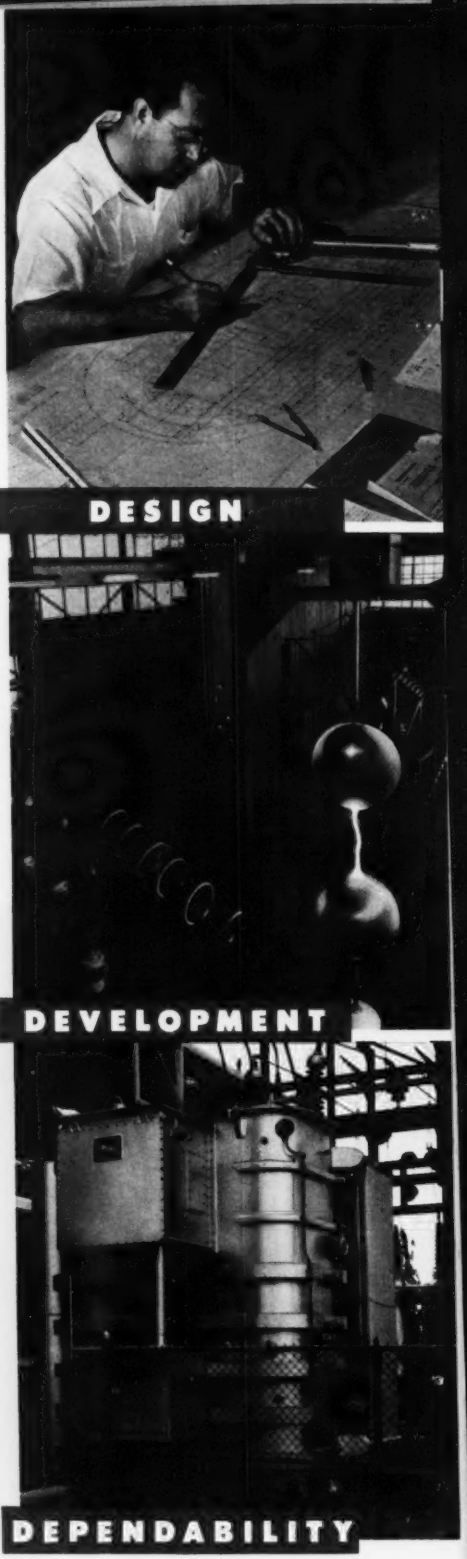
DESIGN by leading engineers with years of experience brings you more compact, efficient transformers that perform better, longer.

DEVELOPMENT of new ideas, techniques, and materials in Moloney's laboratories makes the latest and best available for your use.

DEPENDABILITY is engineered and built into every Moloney Transformer. Moloney Transformers go on the line and stay on the line without failure . . . for years, and years, and years.

Specify equipment backed by over 50 years of proven performance . . . make it Moloney *all along the line.*





Litho in U. S. A.

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers • Step Voltage Regulators • Unit Substations

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

Whither Goest Distribution?

How can reliable service be provided for residential customers at a justifiable cost?

Will service voltage be raised to reflect tomorrow's electrical usage?

Should 3-phase service be provided in residential areas for air-conditioning motors or house heating?

Will tomorrow's plant show greater use of cable?

These are typical of the questions which confront distribution engineers today. They are vital questions, for their answers will reflect increasingly in future distribution costs.

Brilliant efforts to match inflation with better planning, improved materials, labor-saving, and fuller utilization of equipment capabilities have paid dividends. Investment statistics show continuous decline in the percentage for distribution.

But heavier loadings incur higher losses and tighter operation. Both tend to boost operating costs to offset part of the capital savings. And in this respect it is doubtful whether distribution can show economies to match those of new generating stations.

Distribution engineers face difficult problems. And no matter what solutions they evolve, benefits accrue only as additions to the existing system put them to use. Today's practices shape tomorrow's systems. And today's thoughts foreshadow tomorrow's practices.

Possible trends are discernible in numerous recent proposals. Service voltages have broken through the 120/208-v secondary-network ceiling. Air conditioning in several buildings is served at 440 to 575-v from spot networks. These are usually completely isolated from the 120/-208-v system except that the same high voltage feeders are used. Now one large utility is talking 266/460-v as an optional standard for large buildings.

Pros and cons of 4-kv vs 11 to 13-kv primaries have been argued for years. Recent reports confirm that 4-kv is capable of serving foreseeable growth of many load areas. Local conditions, particularly the next higher voltage extensively used on the system, will be determining factors in future changes.

Use of banked secondaries, long promoted for residential service, is expanding. But some companies are encountering difficulties with large spot loads. Overhead secondary networks have been proposed as a solution.

Heat pumps and panel heating are spreading. After careful trial and review, some utilities are actively promoting electrical house heating as a desirable load. A rapid swing to this new use will bring new levels of distribution system capability and reliability.

Necessity for service reliability is encouraging the adoption of performance standards to guide system design. And several extensive analyses of how to meet this need economically are in progress.

These trends in present practice, and even more the thoughts of the engineers who will create tomorrow's practices, merit careful analysis. Electrical World has launched a survey to assemble them. And as the data are classified and analyzed, more order will show through the apparent confusion. With the customary cooperation of utility engineers, Electrical World will present a series of authoritative reports on where distribution is going.

Let History Repeat Itself

Suppose we just assume that when coal was discovered in America, it was sensed then and there that it represented fabulous wealth in one direction and dire threats in another direction if any of the European monarchies got any of it away from us to burn in their battle-wagons. At once a law was passed prohibiting anyone but the Bureau of Mines from digging any of it, coveting it, possessing it, transporting it, or using it for any purpose whatsoever. As a consequence the United States of America never emerged as an industrial nation, it stayed an agricultural country. It set no pattern of rising living standards, no goal of untrammeled initiative for the world to imitate. The coal stayed in the ground against the day when it might be needed for war, even while it could have been used to sustain productive industry capable of supporting a war.

Nuclear fuels are admittedly not an exact parallel, but the factors of restraint operating around them are akin to the it-never-happened analogy concocted for coal. Barring America's forward-pushing industrial enterprises from free play and access to the nuclear fuels may prove to be just as throttling and hamstringing as would have been the case had coal been kept out of circulation all through those decades that saw this country outstrip all others in productive progress, economic freedom, and political liberty.

Let's allow the unraveled atom to go to work as freely as coal was. History deserves a chance to repeat itself.

Dispelling the Fears of Wall Street

Farmer Brown, Widow Smith, and even School Teacher Jones probably have a lot of confidence in the local power company serving them. But when it comes to investing their savings in its stock, that is an entirely different matter. As they will tell you, stocks have something to do with Wall Street. And as too many Americans "know," "Wall Street ain't to be trusted."

To laugh off the fears of these uninformed people is not good business for the investor-owned electric companies. In 1954 they will put on the market over $1 billion of new common stocks. Each potential stockholder is too valuable to be lost. So there is an education job to be done.

To make that education a bit easier, the New York Stock Exchange has just published a booklet, "Understanding the New York Stock Exchange." Written in clear, down-to-earth style, it answers the questions the uninformed ask about the exchange, stocks, bonds, brokers, and security prices. The booklet is available from the exchange. It is up to the electric companies to use it to the greatest advantage.

The Contest Everybody Won

Of 190 communities entered in the 1953 Champion Home Town Contest, sponsored by Georgia Power Co, 40 have been announced as prize winners. But this doesn't mean that 150 communities have lost. Actually all 190 plus the state and Georgia Power won. Because of the purpose of the contest there could be no other result. Each contestant was to make itself a better town by fostering one or more civic improvements. Each community won to the extent that it improved itself. Georgia won because any local improvements automatically improve the state. Georgia Power won because anything that improves the communities it serves naturally improves its business.

In a few other states electric companies are conducting similar contests. But there are more areas in which electric companies might consider launching such campaigns. It is well to remember that you can't go wrong with a contest in which everybody wins.

How Much Hot Water?

Our Hawaiian brothers are setting a fine example in the promotion of all-electric homes. The average annual use per customer of over 6,000 kwhr for The Hawaiian Electric Co attests to this fact. The sales records showing that home owners are selecting electric water heating in 80% to 90% of the cases where they have the opportunity is further proof.

But this fine example of salesmanship is not without problems. To satisfy the hot water requirements of these all-electric customers, water heater recovery rates must be greater than the 8 gal per hour supplied by standard heater elements. The Hawaiian Electric Co permits 4 kw of capacity in 30 and 40-gal water heaters. The two 2-kw units are not interconnected, and recovery rates are 20 gal per hour. Apparently the distribution system can supply this demand, and the rates will cover cost of service.

Such uncontrolled water heater loads have been carefully avoided by most utilities on the mainland. It has always been thought that the water heater had to produce a little more than its share of revenue to help out the electric range. But perhaps the time has now come to review the customer needs as well as the company earnings. Now may be the time to reexamine industry water heater standards.

You Can't Beat an Electric Range

The American Gas Association has proudly announced that the gas range has gone modern. After a lengthy development and testing program eight manufacturers are reported to be ready to market ranges equipped with automatic ignition devices instead of pilot lights. The new ignition device is an electric igniter coil. The advantages claimed for it are that it cuts heat in the kitchen and reduces gas bills.

But there has been a range with these advantages on the market for years. It is known as the electric range. This not only keeps the kitchen cool even when food is being prepared, but it also cuts gas bills 100%. Millions of women are using this range. Millions more will use it when the industry convinces them that there is only one way to be modern—that is, to live electrically.

The Nation's Optimistic Industry

In these days when most industries are expecting less business, the electric utility industry can see only more business ahead. Latest proof of this is the semi-annual power survey of Edison Electric Institute. For details of this optimistic report see page 120.

THE ELECTRICAL WEEK

The Issue's News Highlights—Need for cooperation between federal government, local government, and industry was stressed at resources conference attended by leaders in power field . . . AEC again asks for private industry participation in construction and operation of first atomic reactor plant.

Six Northwest utilities are ready to enter partnership with federal government in construction of hydro projects . . . EEI estimates power reserve margins for 1954 at 17.1%.

President Eisenhower, in his post-Bermuda address to the United Nations, proposed that an international atomic energy agency be set up under the aegis of the U.N. The agency would create a "bank" of fissionable material contributed by "the governments principally involved"—as of today, the U. S., Great Britain, Canada, and the Soviet Union—for use in developing the atom for peaceful purposes. "A special purpose," said the President, "would be to provide abundant electrical energy in the power-starved areas of the world."

At the NAM's 58th Congress of American Industry in New York, Eugene M. Zuckert, a member of the U. S. Atomic Energy Commission, discussed changes in the McMahon Act: "Certainly the legislation should constitute a commitment to industry that if it gets into this (atomic) race, takes risks and gets results, there will be profits to industry."

Christmas present to towns served by Utah P&L and Western Colorado Power is free electricity for holiday lighting in streets and parks. Last season the companies donated 261,188 kwhr to light 45,000 lamps in 115 communities.

Puget Sound P&L Co signed a 20-year power contract with Bonneville Power Administration. Pact is similar to agreements BPA previously had reached with four other private utilities in the region.

Public Relations . . . Electric Companies Advertising Program will present its TV show, "You Are There," over 94 CBS stations in 1954. The program may be seen in the service areas of all member companies where TV is available.

John H. Huss, executive director of Michigan Municipal League, announced support of a bill coming up in the state legislature that would give Michigan's 40 municipal utilities authority to issue revenue bonds to finance expansion.

Philadelphia Electric Co received the Industrial Readiness award of the Philadelphia Civil Defense Council at a meeting of the company's employee association.

An offer by PS of New Mexico to buy the electrical properties of Basin Light & Power Co in northwestern New Mexico for $1.4 million is being considered by the Town Board of Farmington, which controls the system.

Off the Washington Wire . . . AEC is preparing a five-year government program for research and development on nuclear power reactors, to be submitted to Congress in January.

Goals for electric power expansion under the Defense Mobilization Act have been filled, but an effort is still being made to raise them. Main effect would be to reopen consideration of applications for rapid tax amortization.

State of Washington is slated to put on its case for private development of the Hells Canyon site at FPC hearings this week. Hearings are to recess about Dec. 16 or 18 until early January.

Hearings into Interior Department power policy, being conducted by the antitrust subcommittee of the Senate Judiciary Committee, may be carried over into January.

Sacramento Municipal Utility District filed public notice that it intends to ask for water rights for an $80 million hydroelectric and water development project on the upper reaches of the American and Rubicon Rivers . . . District also disclosed plans to build facilities worth more than $6.5 million to enable it to take direct delivery of power from the federal government's Central Valley Project.

Arizona Power Authority is negotiating to buy the $50 million USBR power transmission lines serving the state. Backbone of the system is a major highline running from Hoover and Davis Dams diagonally across the state to Cochise County in the southern section.

Long Island Lighting Co put its 100,000-kw Far Rockaway Plant on the line. Cost of plant and substation totaled $19 million . . . Louisville G&E announced it would begin construction immediately on a $13.8 million, 100,000-kw addition to its plant on the Ohio River below Louisville, Ky. First 100,000-kw unit will go on the line next summer.

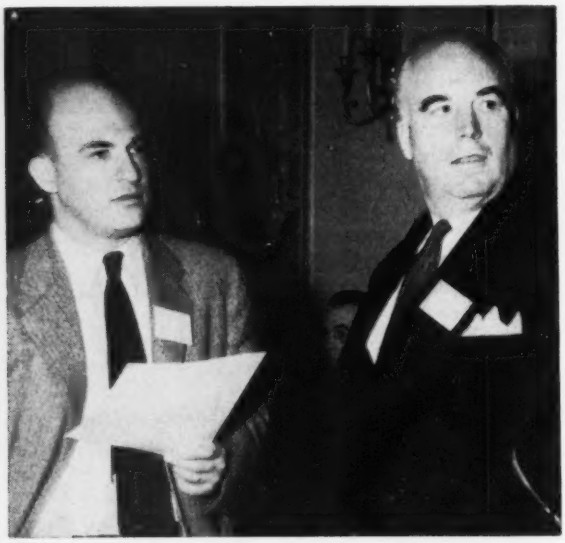
New York Telephone Co purchased Consolidated Edison's two-way radio system, which it will service and maintain for the utility. Con Ed will retain the FCC license.

Foreign sales of electrical equipment in the U. S. in the first six months of 1953 ran 50% ahead of the same period in 1952, a report to Nema by National Industrial Conference Board revealed. About 80% of foreign quotations on public bids for electrical equipment in Latin America and Asia in the last 18 months were lower than U. S. bids by 20%.

Executive Changes—Robert W. Wilson, executive assistant to the president of Potomac Electric Power Co, was elected vice president of the utility . . . Howard K. Crabtree was appointed a vice president of New England Power Co and Connecticut River Power Co. Crabtree formerly was assistant to William R. Bell, vice president of both companies.

H. S. BENNION
Edison Electric Institute

HENRY B. SARGENT
Arizona Public Service



ALEX RADIN
American Public Power Association

WILLIAM WISE
Former REA Official

Mid-Century Resources Conference gathered private and public power leaders for

Round-Table Discussion on Energy

Need for cooperation between all levels of government and private industry was a recurring theme at the Mid-Century Conference on Resources for the Future, held Dec. 2-4 at Washington, D. C.

R. K. LANE
Public Service of Oklahoma

The conference, sponsored by Resources for the Future, Inc, with financial aid granted by the Ford Foundation, brought together 1,500 representatives of industry, government, public agencies, and civic groups interested in conservation and expansion of the nation's natural resources. The representatives spent most of their time attending sessions of eight separate sections, each dealing with a specific phase of the resources problems. Since the purpose of the conference was to "block out areas of agreement," no recommendations or proposed programs came out of the discussions.

Tripartite Co-operation . . . In the section on Energy Resources, for which 170 persons registered, the need for tripartite cooperation in developing the nation's power resources was sounded most eloquently by C. Petrus Peterson, Bankers Life Insurance Co, Lincoln, Neb., and president of National Reclamation Association.

Peterson asserted that combined efforts of private industry, local, and federal government agencies would be required to meet the nation's power needs. The federal government, he said, "should not be shouldered with

THOMAS DELZELL
Portland General Electric

the burden of electric supply, because it is too big a load."

The big question, declared Peterson, is how to get the three groups to work together. This cannot be done by name-calling and questioning one another's motives, he said. Peterson said he believed the current management of most utilities are prepared to work as a team with the other agencies.

Fair Use of Yardstick . . . The white-haired reclamation leader said that if government power operations were to be used as a "yardstick" by which to measure operations of the private companies, the yardstick should be applied to both sides equally. How can rates be the same, he asked, if one group does not pay taxes, and another group does?

Peterson also expressed the belief "cheap" power had been overemphasized. "You can make it as cheap as you want by bookkeeping," he asserted. The Nebraskan said he saw no reason for selling power for less than it was worth.

In concluding his extemporaneous remarks, Peterson declared that in the power controversy "too much heat and not enough light will get us nowhere."

Advance Planning . . . R. K. Lane, president, Public Service Co of Oklahoma, pointed out that coordination of facilities of public and private power groups should be discussed before the projects actually are built. Areas of agreement, he said, should be reached before competitive facilities are undertaken. Criteria for deciding what projects should be constructed, the utility president declared, should be what is best for the people at large.

Another utility spokesman, Thomas Delzell, president of Portland General Electric Co, told members of the Energy Section that decision on whether a community should be served by public or private power should be left to the people themselves. The government, he said, should only do what it can do best and what cannot be done by other groups. He added that non-federal agencies—public or private—should build transmission lines from federal projects.

No Single Solution . . . On the public power side, Roland A. Kampmeir, Tennessee Valley Authority, expressed the opinion that there is no single answer to the questions of how federal power should be distributed to consumers or who should develop major water power sites. He declared the country would be better off if more than one approach were tried than if it were decided dogmatically that one method was the best answer.

The question of the preference clause evoked a much wider difference of opinion among those attending sessions dealing with electric energy.

Delzell declared that the preference clause prevents fair and equitable distribution of federal power. "There should be no first and second class citizens" when it comes to distribution of power, he asserted.

Preference Clause Defended . . . Alex Radin, American Public Power Association, however, took the view the preference clause has not resulted in monopolization of power by preference customers. Instead, he said, it has prevented monopolization by those in the best position to obtain such power. Radin asserted that two-thirds of the federal power now goes to private utilities and industrial firms.

William Wise, Washington attorney, and former deputy administrator of Rural Electrification Administration, expressed the fear that if federal power were sold at the busbar to the private companies, savings would not be passed on to consumers.

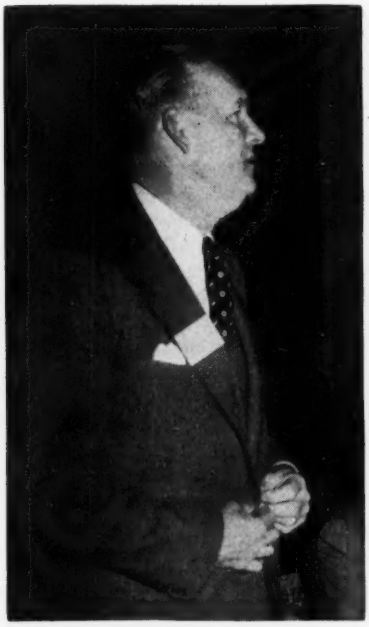
But Delzell pointed out that utilities are regulated by state commissions and profits held to a reasonable level. He contended savings are passed on to consumers.

Clash within CIO . . . The sharpest disagreement on the power issue seemed to be within the Congress of Industrial Organizations.

Harold J. Straub, Utility Workers Union of America, CIO, stated his union's traditional position of opposition to government in the power business. He said government operations in this field should be curtailed as much as possible and advocated that the power business be turned back to private industry.

Straub pointed out that CIO President Walter Reuther has taken the position that the government should step in and build power facilities only when private industry cannot meet all energy requirements.

But Anthony Smith, assistant general counsel for the CIO, took a very different view of national CIO's power stand. He said the CIO stood behind TVA and urged application of lessons learned at TVA in other regions of the country. He came out for federal construction of all hydroelectric projects and advocated that all federal power be distributed by public agencies. Public power, he said, should serve as a yardstick to measure the operation of private util-



S. R. FINLEY
Chattanooga Power Board

ROLAND A. KAMPMEIR
Tennessee Valley Authority

ities. Smith expressed doubt that state commissions do an effective job of regulating utilities.

Atomic Power . . . Discussion on development of atomic power also produced a clash between union men.

Smith demanded public ownership and control of patents, materials and processes in atomic energy developments. He roundly criticized the Atomic Energy Commission for its plan to build a power reactor "by farming out the job to monopolistic corporations."

A representative of the American Federation of Labor, Maywood Boggs, Boiler Makers Union, took an opposite viewpoint. He summed up by saying "Public monopoly can be just as bad as private monopoly."

There seemed to be some agreement, however, that atomic reactors would not produce any significant amount of power within 20 years.

Chairman of the section on energy resource problems was Farrington, Daniels, University of Wisconsin. Henry B. Sargent, president of Arizona Public Service Co, replaced George Gadsby, who could not attend, as co-chairman. Members of the steering committee included S. R. Finley, general superintendent, Chattanooga Power Board, and C. Petrus Peterson.

Areas for Research . . . In the section dealing with problems in resources research, Philip Sporn, president of American Gas & Electric Co, outlined areas in the energy field where research was needed. These included purification and combustion of coal to avoid waste and pollution, safety of operating atomic reactors, possibilities of gas turbines, and fuel cell.

Other sections of the conference dealt with land resources, water resources, nonfuel minerals, world resources, and patterns of cooperation. Reports on the proceedings are expected to be published later.

The conference was the first major project of Resources for the Future, Inc. In summing up the accomplishments, former Ambassador Lewis Douglas, conference chairman, said that the conference had identified domains of agreement and areas of disagreement in the approach to natural resources problems, and that the exchange of views by a wide assortment of individuals of a great variety of skills and talents had clarified the reasons for disagreement in this field.

AEC Again Asks Industry Aid

Private capital gets second call to help build nuclear reactor. Other cooperative arrangements considered

Atomic Energy Commission is stepping up its efforts to gain private industry participation in the construction and operations of its first utility-size nuclear power plant.

The government agency has issued a second invitation for investment of risk capital in the recently announced project to build a nuclear reactor for generating electric power (EW, Nov. 2, p 75). This bid went out after a series of discussions between AEC and industries already participating in some phase of nuclear power reactor development.

No Attractive Offer . . . Although AEC declined to comment on the nature of these conferences, it was indicated that no attractive firm offer for large-scale industrial participation has yet been received. Some AEC officials are pessimistic about bringing a sizable amount of risk capital into the venture, but still hope for other forms of private participation.

A tentative deadline of Feb. 15 has been set for entertaining offers from private industry. This can be extended if conditions warrant.

Decisions which might hinge on proposals for private financing are being delayed until AEC is sure that all offers are in. Primary among these is the selection of a site for the plant which will have a minimum capacity of 60,000 kw. While AEC has said the plant might be located near one of its heavy-power-using gaseous diffusion plants, it is still free to put it some place else if it could be fitted into a private financing proposal. Several engineering and architectural decisions are being delayed for the same reason.

Mainly Construction . . . Areas for private industry participation are mainly in construction of the more conventional parts of the proposed power plant and operation of both the plant and the reactor. For instance, an electric utility might offer to build the turbine and generator portions of the plant and take steam from the federally constructed portion. Or the utility or other privately owned industry might also assume responsibility for the heat exchanger—relying on heat from federally built reactor.

While it may be possible to operate the conventional portions and the reactor under separate management, government officials lean more to a single management operation with the hope that private industry will take on the job.

In a like manner, industry has nearly a free field for proposing arrangements for participation. Some participation may come from "gifts" or "exchanges." An example would be the sort of technical aid already furnished in other AEC projects where engineers from industry are loaned to AEC for specific projects.

Contractual Methods . . . A second form of participation would be through contractual arrangements.

A third form of participation would involve more risk, with industry assuming a partnership responsibility in building and operating the nuclear power plant. The government would build and own the reactor portion of the plant, but industry would depend on output of the plant to return its investment and possibly a share of the government investment.

5 Companies Set Up Nuclear Power Firm

Five private companies plan to file incorporation papers in nine states for a jointly owned firm to be called Nuclear Power Co, which was formed to produce electricity from atomic energy. Atomic Energy Commission has approved the new firm. The companies have been studying use, design, and economic problems of power from atomic reactors.

The companies, which have equal shares in Nuclear Power, are American Gas & Electric Corp, represented by its subsidiary American Gas & Electric Service Corp, Commonwealth Edison Co, Pacific Gas & Electric Co, Union Electric Co of Missouri, and Bechtel Corp, San Francisco engineering firm.

NW Utilities Set for Federal Tie

Companies would supply 'total power requirements' of customers, if government would underwrite multipurpose aspects

Six Pacific Northwest power companies are ready to enter into partnership with the federal government in construction of hydroelectric projects which will enable the companies to supply the "total power requirements" of all their customers, J. E. Corette, president of Montana Power Co, revealed at a meeting in Seattle, Wash., called by the governors of the four Northwest states.

The companies have formed an informal organization and have been studying prospective power sites for the past three months, said Corette. They expect to file an application with the Federal Power Commission this month to carry out preliminary investigations on one or more sites on the Columbia River or its tributaries.

Sites Uncertain . . . Corette refused to indicate which sites are under consideration. Most prominently mentioned in this connection, however, have been the 1,105,000-kw John Day project on the Columbia between The Dalles and McNary Dams and the 260,000-kw Ice Harbor Dam on the Snake River near its juncture with the Columbia.

Companies involved, in addition to Montana Power, are Idaho Power, Mountain States Power, Washington Water Power, Pacific Power & Light and Portland General Electric. A seventh, Puget Sound Power & Light Co, will be asked to participate.

Some of the projects under investigation are "very large" and would provide more power than any single company could use, said Corette. Financing presumably would be handled by the companies buying stock in a generating company, and the issuance of debenture bonds.

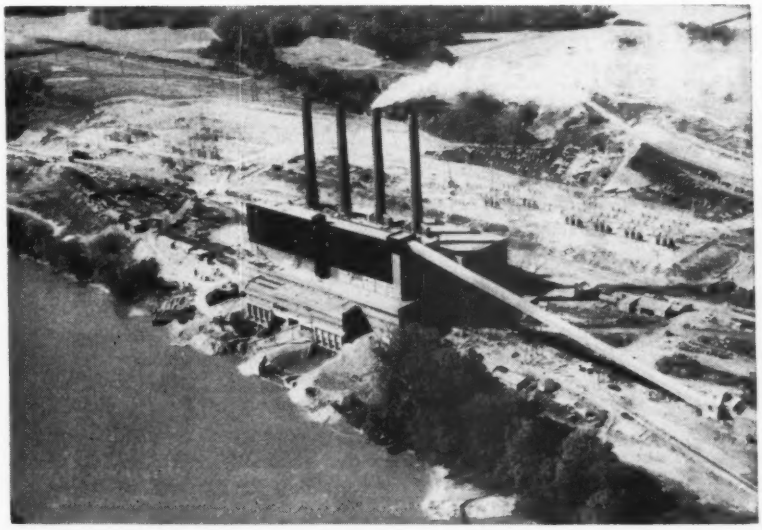
Multipurpose Help . . . If the federal government would bear such costs as could be charged off to flood control, navigation, recreation, etc, the companies could finance the power phase of a project, Corette said. Ralph A. Tudor, Undersecretary of the Interior, has indicated such a division of costs might be possible. A joint project "possibly" could begin producing power by 1960, the first year in which a shortage is anticipated in the Northwest under present construction schedules, said Corette. A "pot" already has been made up to pay the costs of preliminary investigations.

Projects under study would not conflict with dams proposed by other agencies, declared Corette.

First reaction to the proposal was favorable although Gov Arthur B. Langlie of Washington pointed out that it needed to be amplified and studied in connection with other partnership proposals. Unless "the right dams are built at the right sites," costs will be too high and the public will suffer, he said. Public agencies indicated they would reserve comment until the sites are announced but expressed a concern that projects be built where they could utilize waterflow to the greatest extent. All comments agreed that the estimated need of 6 million kw of additional generation in next 20 years would call for private and public construction.

Private power companies are understood to be aiming for a construction goal of 250,000 additional kw a year. Some speculation centered around prospects of installation of additional generators by private companies at existing federal dams.

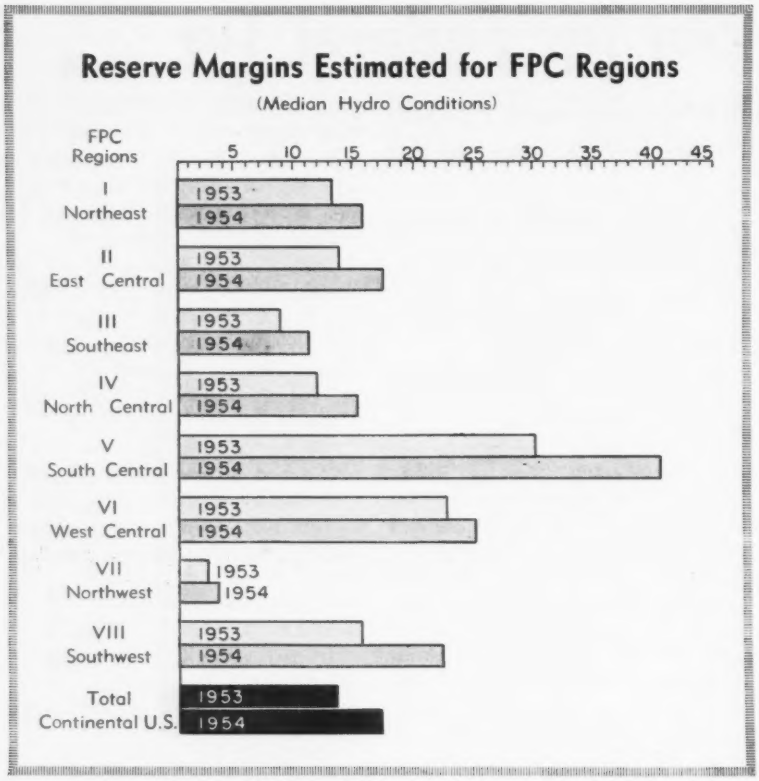
The Seattle conference, attended by public and private power producers and distributors in the area, resulted in formation of a policy committee including the governors, a representative of the British Columbia provincial government, members of the Northwest Power Pool, Department of Interior, Army Corps of Engineers, Federal Power Commission, and the chairman of the Interstate Compact Committee.



Wabash River Station Work Advances

Public Service Co of Indiana reports that work on its Wabash River Station is progressing at such a rate that two 100,000-kw units are expected to be in operation before the end of the year. The company also expects to have the second section of its 230-kv transmission system completed and energized shortly. This section will connect the Wabash station to the Columbus 230-kv substation.

The 230-kv circuit, said to be the first in Indiana, has been superimposed on Public Service's 132-kv system. The line has a capacity of 220 kw. The three main terminals of the 230-kv line are: Wabash River Station, Kokomo Highland Park Substation, and the Columbus substation.



EEI Forecasts 17.1% Reserve

Edison Electric Institute has forecast that electric power suppliers in the United States will have a reserve of 17.1% for 1954 as compared with the 1953 estimated reserve of 13.4%, which is lower by 1.2 percentage points than EEI estimated last April.

Reserve forecasts of 17.1% for 1954, 18.7% for 1955, and 17.4% for 1956 are based on capabilities of 106.5 milloin kw, 117.2 million kw, and 124.3 million kw and differ from those estimated last April by less than 1 percentage point.

These forecasts were made by the Institute's Power Survey Committee in its 14th Semi-Annual Electric Power Survey published last week.

Peak Loads . . . Peak load for 1954 was estimated at 90.9 million kw, an increase of 10.8% over the 1953 estimate of 82.1 million kw, which is below the April estimate. For the year 1955, an increase of 8.6% in peak load was predicted for a total of 98.7 million kw, and for 1956, a 7.2% increase for a total of 105.8 million kw.

Capability at the end of 1953 was placed at about 93 million kw, which is 1.8 million kw less than was reported in the committee's survey made in April.

The Survey Committee has expressed the belief that it will not be possible to complete the entire 1953 expansion program before the end of the year and that many projects slated for operation in the last quarter will not be in service until 1954. Thus, the committee estimates that total capability at the end of 1953 and 1954 will be less than shown by survey results as indicated in the following table:

Estimated Total Capability
Median Hydro Conditions

	(Millions of Kw) End of 1953	End of 1953
As shown by results of the survey	93.1	106.5
As estimated by the Survey Committee not more than	92	104

In its report the committee noted annual load curve changes as a result of increasing power requirements for air conditioning and pumping for irrigation as emphasized during the current year by abnormally hot and dry summer weather. The effect in many parts of the country was to create a summer peak load approaching or exceeding the previous winter peak. The report noted that the filling in of the summer valley may increase the amount of reserve for satisfactory operation of the systems.

A higher margin of reserve was seen in 1954 in all regions as compared with 1953. Further increases are expected in 1955.

Adverse Hydro Conditions . . . In adverse hydro conditions, there is expected to be larger margins in 1955 as compared with 1954 in all regions except Region I, where reserve will remain the same. But, reserves are expected to be lower in 1956 in all regions except Region V, where margin is expected to increase from 41.6% to 42.1%.

In adverse hydro conditions, deficits are estimated for Region VII with 4.2% for 1954; 4.7%, 1955; and 1.2%, 1956. The region's Western Division's deficits are estimated as 6.6% for 1954; 7.3%, 1955; and 4.8%, 1956. No deficits are forecast for the Eastern Division.

I-T-E Circuit Breaker Buys Victor Insulators

I-T-E Circuit Breaker Co, Philadelphia, Pa., has acquired Victor Insulators, Inc, Victor, N. Y., manufacturers of high voltage electrical porcelain insulators. I-T-E, which manufactures their circuit breakers, air break disconnect switches, and switchgear, will further broaden its line of electrical products in the transmission and distribution field with the acquisition of Victor.

Victor Insulators will continue to operate under its own corporate named in Victor, N. Y., as a subsidiary of I-T-E. W. M. Scott, Jr, president of I-T-E, will become president of Victor and Edward A. Halbleib, now its president, will become chairman of Victor's board of directors and will join the I-T-E board shortly. No other changes in Victor's personnel or policies are presently contemplated.

Write-Off Rule Favors Utilities

FPC says rapid tax amortization should have no effect on companies' ratemaking structures

Federal Power Commission will ignore the effects of rapid tax amortization in exercising its ratemaking authority.

But electric utilities and gas pipelines under FPC rate jurisdiction will be required to earmark any accruals under the fast amortization program for future tax payments.

This position was taken in a four-to-one decision by FPC in announcing its policy for treatment of fast tax write-offs in rate cases.

Will Not Push Reductions . . . The majority said FPC would not force rate reductions on utilities because of benefits arising from use of necessity certificates providing rapid tax amortization. To do so, said the majority, "would be inconsistent with the effort of Congress to aid our national defense."

FPC also rejected a proposal that cash savings which accrue during the five-year period of accelerated amortization period be charged to the depreciation reserve. Effect would be to deduct this amount from the rate base of the utility.

"Deferred taxes are not depreciation," said FPC, "and should not arbitrarily be labeled as such in order to prevent the certificate holder from receiving what our government has given him."

Commissioner Dale E. Doty, in a dissenting opinion, said the FPC majority will require ratepayers "to pay far more than a fair return for utility services, contrary to a long line of precedents established by this commission which have been upheld by the courts."

He called, instead, for allowance of accelerated depreciation expense and the deduction of the resulting depreciation reserve from the rate base in fixing rates. This allowance, he said, "would avoid the messy accounting which, I am sure, will ultimately be abandoned in the plan approved by the majority of this commission."

Accounting Decision Later . . . In announcing its policy on the ratemaking aspects of fast amortization, FPC said it would deal with the accounting phase at a later date. Hearings on treatment of accelerated amortization in regard to ratemaking and accounting were held in March. A second hearing on the accounting aspects was held in October.

Electric companies under FPC jurisdiction have received certificates relating to a gross investment of more than $2.5 billion of which $1.2 billion is actually certified for rapid tax amortization.

Not For Dividends . . . In its policy statement, FPC said that while it is clear Congress did not intend to make gifts through lower rates to the customers of the companies which received certificates, "it is equally clear that Congress did not intend to provide a temporary fund to these companies which could be diverted to the payment of dividends to their shareholders."

Accruals for taxes in excess of those actually paid should logically be treated, not as free and unrestricted income, but earmarked to provide for the future meeting of such liability, said the majority.

It waved aside charges that the certificates were improvidently issued on the grounds FPC could not usurp the authority or veto the acts of another government agency.

To a contention that certificate holders will receive an undue advantage because income tax rates probably will be reduced in the future, the commission said Congress was undoubtedly aware of this possibility when it enacted the legislation. "We have no power to enact different legislation," FPC added.

Tornadoes Cause Havoc in South

A crushing loss of life and property resulted from tornadoes that swept through wide areas of the Southland this month. Altogether, 30 persons were killed in the tornado that raged through downtown Vicksburg, Miss. (see above) on Dec. 5. Included in the property damage of $25 million was some sustained by Mississippi Power & Light Co. A company substation and office in the city were hit slightly, while many lines and transformers were knocked down. However, the company restored service within an hour and a half in areas unaffected by the twister. After a weekend devoted to clearing debris, service was set throughout the city. Three days earlier, nine lives were lost as tornadoes struck through central Louisiana. Slight damage was caused to distribution systems operated by Central Louisiana Electric Co in Rapides and Grant parishes. No transmission lines were affected. Service was restored in one to three hours.

Marketing Criteria Debated

Interior officials defend department's new policy under attack from Missouri Basin consumers group at Senate hearing

Interior Department officials and leaders of the recently formed Missouri Basin Electric Consumers Association traded charges of "monopoly" as a Senate committee launched hearings on Administration power policy.

Center of the controversy is the power marketing criteria announced in September by Bureau of Reclamation for disposing of power from federal dams in the Missouri Basin.

Cites Harm to Co-ops . . . William C. Wise, former deputy director of Rural Electrification Administration and now counsel for MBECA, contended that the criteria would result in monopolistic charges for electric energy. He said Interior power policies will bring in "grievous and irreparable" harm to rural electric co-ops which depend on federally produced electricity.

Interior Department officials headed by Undersecretary Ralph Tudor countered that opposition to the new criteria is being sparked by persons who favor a 100% government monopoly in power production.

Scope Widened . . . The hearings were conducted by the antitrust subcommittee of the Senate Judiciary Committee under chairmanship of Sen William Langer, North Dakota Republican. While the first phase of the hearings was concerned with Missouri Basin power, Langer promised to expand it to bring in all sections of the country which might be affected under Interior power policies.

Decision to broaden the scope of the hearing came after Wise had charged that an underlying pattern of the new policy is to raise federal power rates to rural consumers.

Wise, who is a partner in the law firm which represents National Rural Electric Cooperative Association, was given free reign at the hearing to question Interior witnesses at will. In a like manner, Interior officials often spoke out of turn to defend their policies.

Open Discussion . . . The hearing resembled an open discussion rather than a Congressional inquiry. Wise had been retained by MBECA after the group had resolved to enjoin the federal government from enforcing the Missouri Basin power marketing criteria. It appeared that the hearing might be taking the place of a more formal court suit.

Item in the criteria drawing the most fire was absence of the "withdrawal clause" which had been a part of previous criteria administered by Bureau of Reclamation. Under such a clause, the government could withdraw blocks of power from non-preference customers such as electric companies when it was needed for preference customers such as rural co-ops.

Both Wise and Virgil T. Hanlon, manager of the East River Rural Electric Co-op in South Dakota, contended that this would work a severe hardship on co-ops and send rates skyrocketing. They reasoned that the only way a co-op could be sure of an adequate federal power supply for growing needs would be to contract for power beyond present needs.

Sees Little Effect . . . Assistant Interior Secretary Fred G. Aandahl said the absence of a "withdrawal clause" would have "little, if any," effect on federal sales to preference customers in the Missouri Basin area. He said short term contracts could be drawn with non-preference customers which would have the same effect as the missing clause.

Aandahl, former Governor of North Dakota, said postponement of the Interior criteria would not help the situation facing co-ops in the area. Their main worry, he said, is not so much the criteria as it is the physical fact that there simply will not be enough federally produced power in the area to meet the needs of preference customers. He indicated that Interior studies have shown the real problem facing Reclamation power men is dividing up available power output among preference customers.

In his testimony, Aandahl defined the purpose of Interior as selling hydroelectric power "at the lowest possible cost on a businesslike basis." He said Interior does not intend to buy large blocks of steam power just so the department could resell it.

Aandahl also attacked the power policies of the Truman and Roosevelt Administrations. He declared "the previous Administration was working in the direction of a federal power monoply." He cited as evidence government construction and purchase of transmission lines and government backing for construction of steam plants in Southwest.

POWER BRIEFS FROM THE NEWS

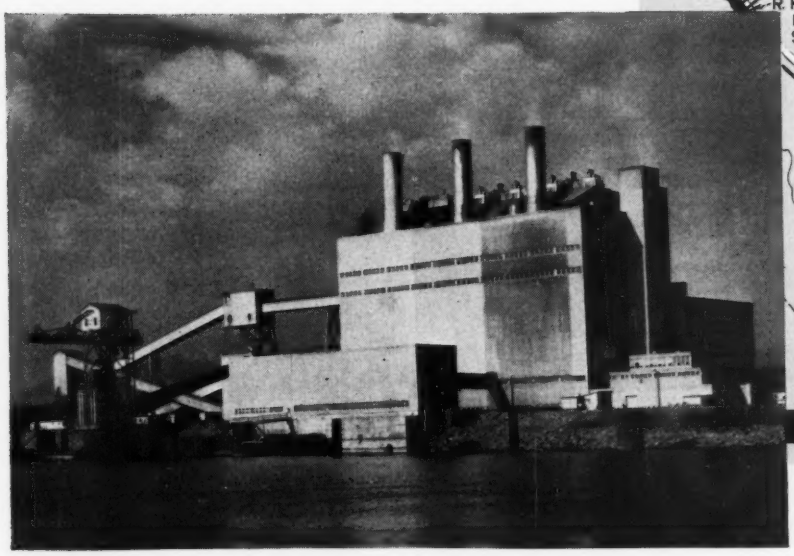
● Seattle City Council has been asked by City Light Superintendent E. R. Hoffman to appropriate $165,000 to complete preparation of plans for adding 125 ft to the height of 540-ft Ross Dam on Skagit River. The project eventually would boost Ross Dam's ultimate capacity to 360,000 kw.

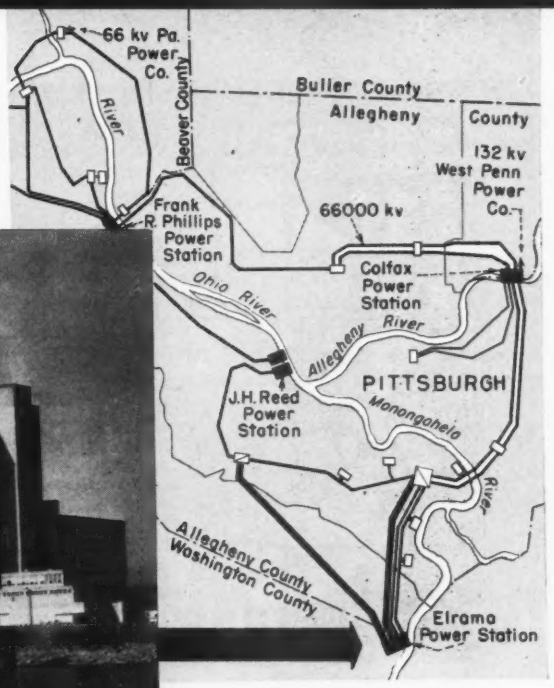
● Florida Power & Light Co plans to expand its Palatka plant with installation of a 80,000-kw generator, which is scheduled for operation in 1956. The new unit will boost Florida P&L's system capability to 957,000 kw.

● In cooperation with the Canadian government, Hydro-Electric Commission of Ontario will carry out a feasibility study on development of an atomic reactor for generation of power. The study will be undertaken at the Chalk River plant operated by Atomic Energy of Canada, Ltd.

● New Zealand plans to exploit geothermal steam in the Wairakei area for production of electricity and heavy water required for atomic energy development as a result of recent tests that revealed a number of shallow bores were capable of producing at least 20,000 kw. The government has assigned two London steam engineering consultants to conduct a survey in the area and prepare a preliminary report and cost estimate for a steam power station with an initial capacity of 20,000 kw.

Rapid expansion of new . . .





power station at . . .

Elrama Demands System Changes

Third generator completes 3-year program to boost Duquesne Light capability by 325,000 kw. Transmission requirements force start of 138-kv system. New unit shows many departures from former practices

J. STANLEY BROWN, Chief Engineer, Duquesne Light Co, Pittsburgh, Pa.

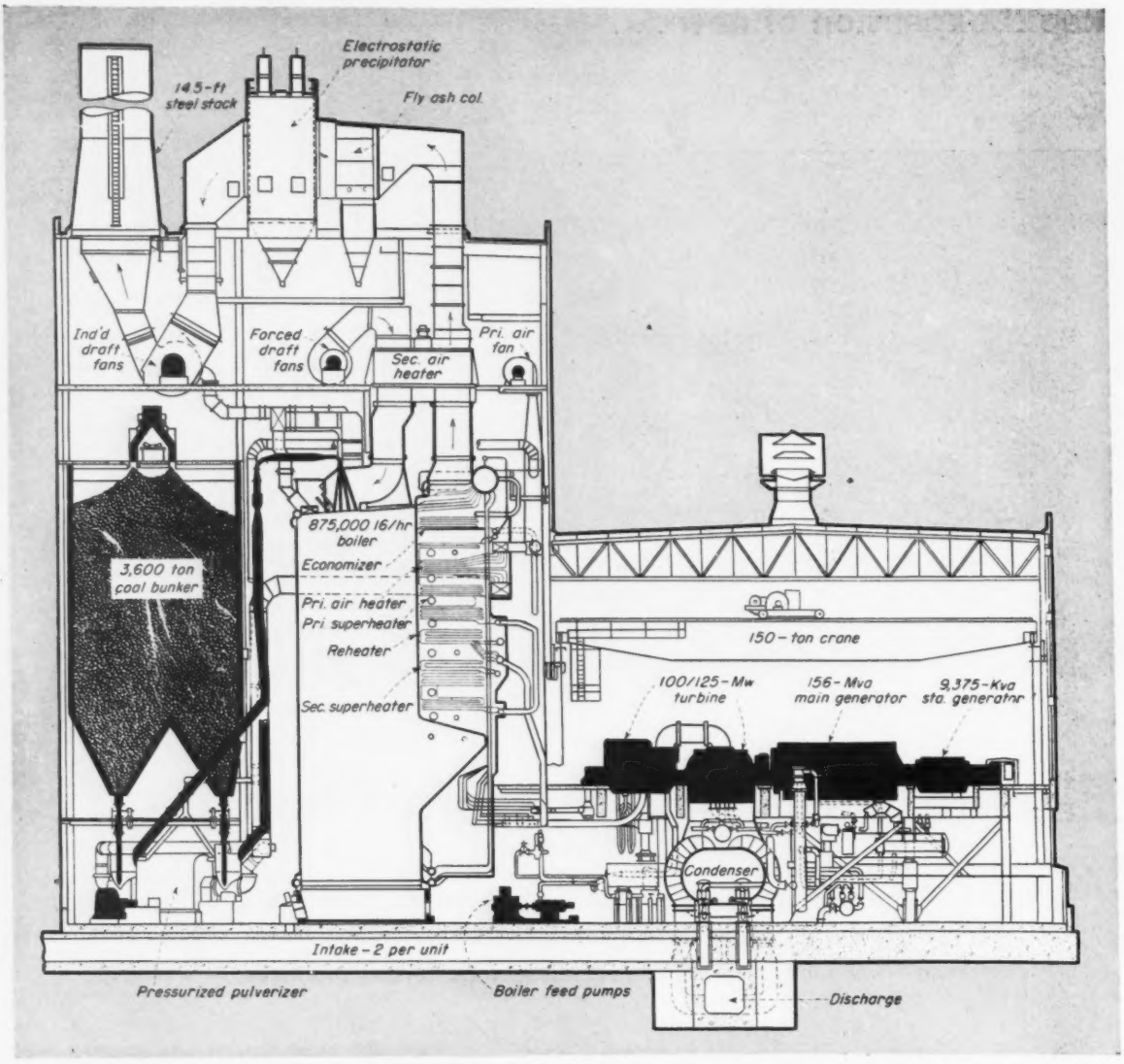
Expansion of new Elrama power station to a rated 260,000/325,000 kw accentuates many innovations to the Duquesne Light system. These include:

- Transmission at 138 kv, reinforcing the 69-kv double-circuit ring which has sufficed for nearly 30 years.
- Unit-type design with only electrical connection between units. This is by transformer to the 69-kv synchronizing bus.
- Magnetic amplifier type voltage regulator with separate exciter.
- Throttle steam pressure of 1,450 psig at 1,000 F for third unit, up from the 1,250 psig 950 F of first two Elrama units.
- Reheat 375 psia to 1,000 F, for first application of reheat to Duquesne Light generation.
- Estimated net fuel rate of 9,600 Btu per kwhr, down from previous approximate 10,300 Btu.
- Louvred-ceiling, high intensity lighting of control room, and special open front instruments for optimum readability.
- Use of prefabricated insulated aluminum "Q" panels to enclose the station.
- Compact design of station and switchyard in 24 acres between railroad and river. Building has only 22.7 cu ft per kw net output.

Rapid load growth in the southern portion of the 69-kv ring between J. H. Reed and Colfax power stations strongly favored that area for a new generating station. A suitable site, fronting on the Monongahela River, was found at Elrama.

Output of the first two units, over 200,000 kw net, was readily absorbed by the existing 69-kv system. Only two double-circuit lines about 10 miles long were required at this voltage. One of these picked up two large blocks of load enroute.

Decision to install the third unit at Elrama brought the change to 138-kv transmission. A large portion of the new generating capacity was needed at more distant load centers. For longer distances, a higher transmission voltage could be justified. Rights-of-way for new transmission are becoming increasingly difficult to obtain in this congested territory, and higher voltage makes better use of them. It was apparent, also, that continued addition of load to the 69-kv system threatened serious future bottlenecks. The new 138-kv lines from Elrama to Dravosburg and to Woodville may constitute the beginning of a new 138-kv ring to reinforce the existing 69-kv system.



COMPACT DESIGN achieves full utilization of building space. Lack of ground forced vertical expansion. Even the roof 150 ft above the ground is used to support the flyash collectors and short steel stacks. Major equipment is served by a 150-ton turbine room crane

Unit construction facilitates adding the new unit with No. 1 and No. 2 already carrying over 200,000 kw at nearly 100% daily load factor. Principal plant interconnection is a 36,000-kva transformer in the Elrama switchyard between the new section and a 66-kv synchronizing bus added to the existing two units. Parallel interconnections are by line-terminal auto-transformers to busses of the existing 69-kv transmission ring at Dravosburg and Woodville substations.

Auxiliary Power Supply . . . Station service has two independent supply sources per unit. One is a shaft-connected auxiliary generator and the other a 3-phase transformer from the 138-kv bus. Both connect to the 2,300-v bus through 5-kv metal-enclosed, segregated-phase leads. A limited capacity 2,300-v bus between units permits starting sufficient auxiliaries to get a unit into operation in case of station service transformer failure. Auxiliaries can then be carried by the 7,500-kw shaft generator.

Two 2,300-v bus sections are provided for each unit. Essential auxiliaries are generally in pairs and divided between bus sections. Switching is by 5-kv, 250,000-kva, 1,200-amp air circuit breakers in metal clad units. And 5-kv cable runs to 2,300-460-v load centers in turbine and boiler rooms, screen house, and coal handling equipment.

"Voltage chasers" automatically transfer station service load from a failing to a good source. Whether initiated automatically or manually, these are "dead" transfers.

Motors approximately 100 hp and smaller are served by 300-kva, dry-type, 2,300-460 transformers and air switchgear assemblies. Each transformer is connected through a 5-kv, load-break, air-interrupter switch. This size of transformer facilitates locating near load centers throughout the plant and limits short circuit duties on switchgear.

Connection to the 460-v bus is by

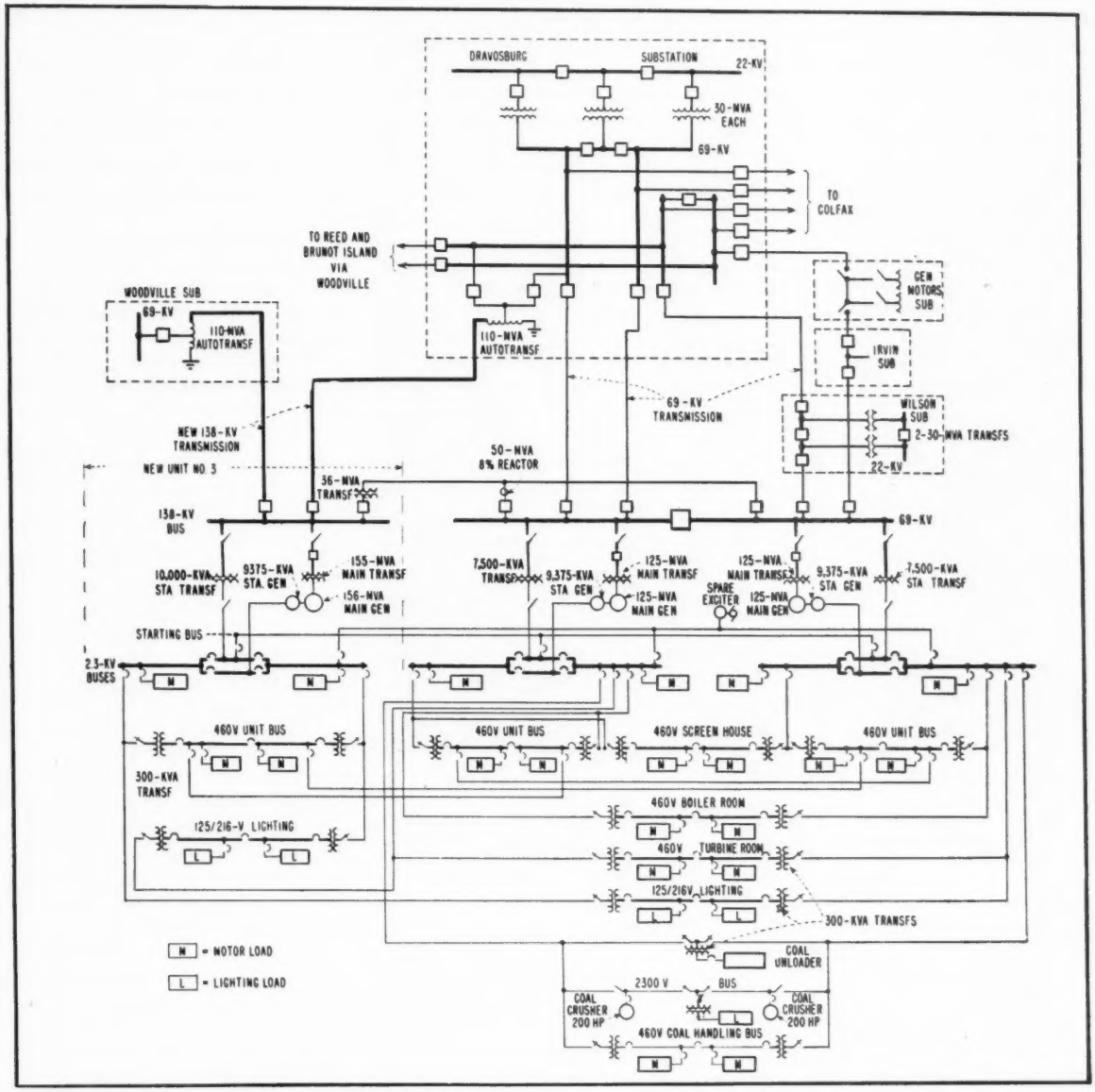
air circuit breakers. Each pair of 460-v buses is tied through a free standing air circuit breaker. Assemblies have 15,000 rms amp feeder breakers and 25,000 rms amp tie breakers, all solenoid operated. Motor load centers use hinge-out magnetic contactors, served through the circuit breaker assemblies.

Station lighting is served at 216/125 v by similar 300-kva transformers.

Characteristics of New Generator . . . The new generator is rated 156,000 kva at 30 psi hydrogen, 3,600 rpm, 80% pf, 16,500 v, 0.9 short circuit ratio. Main generator leads are 15-kv, 6,000 amp, isolated-phase construction, with round copper pipe conductors and aluminum covers. The insulation level provides impulse strength higher than the generator windings. No disconnecting switches are used, but a silver-faced copper "Dutchman" provides a break point for any necessary testing.

Output is tied to the 138-kv bus through a 3-phase, 16-138 kv, 155,000-kva FOA transformer. Breakers are pneumatically operated, rated 138-kv, 1,200 amp, 5,000 Mva interrupting capacity. Unit design permits selecting both generator and transformer to suit present requirements, despite the fact that existing 80,000/100,000 kw units had 13.2-69 x 138 kv transformers.

Excitation System Changed . . . Excitation for each unit is by 350 kw, 375-v fly-wheel motor-generator sets powered from the 2,300-v station service. The new exciter will have a magnetic-amplifier type voltage regulator, unlike previous units which have pilot exciters and rotating amplifier regulators. The spare exciter provided for the first unit is also available through permanent



NEW 155-MVA TURBO-GENERATOR UNIT supplies 138-kv bus which is tied to existing 69-kv system by 36-Mva transformer to Elrama synchronizing bus and by new 138-kv lines to auto-transformers at Dravosburg and Woodville. Unit plan prevails throughout

wiring to air-type switchgear. Bus surge protection is included in the switchgear.

The new 3,600 rpm turbine is a two cylinder tandem-compound, double-flow machine rated 100,000/125,000 kw. Throttle steam is 1,450 psig at 1,000 F from a single 875,000-lb-per-hour steam generator. Unit construction permits selection of the higher pressure and temperature despite the use of 1,250 psig at 950 F in previous units.

Predicted Performance . . . Estimated net fuel rate for the new-unit is 9,600 Btu per kwhr, down from approximately 10,300 Btu per kwhr already established by the first two Elrama units.

Burners are designed for pulverized fuel only. Coal is delivered normally by barge to an unloader at the water front. But rail and truck access to the 240,000-ton storage yard are available.

Two forced draft fans are provided for each unit, driven by single-speed induction motors. Air flow is regulated by multi-vane inlet dampers. And the two induced-draft fans driven by 1,000 hp motors and are similarly regulated.

Mechanical flyash collector and electrostatic precipitator between the boiler and induced draft fans are expected to remove 96% of the solids from stack gases. Both are located on the boiler room roof.

Lighting System Modern . . . Control room lighting of 95 ft-c is provided with a plastic louvered ceiling. And 40 foot candles on the 6-in. square switchboard instruments with special open-face covers gives exceptional readability.

Switchboards are of the steel "gutter" type developed during the past 16 years by Duquesne Light Co. The name comes from the shape of the steel side frames which house control wiring and support front panels. These gutters extend through control room floor to the relay room below.

Relay boards are similar except that the front has additional vertical members to support small individual relay panels. Supporting gutters extend from ceiling through the floor to transite trays in the cable room below. Doors can be added on the rear when required.

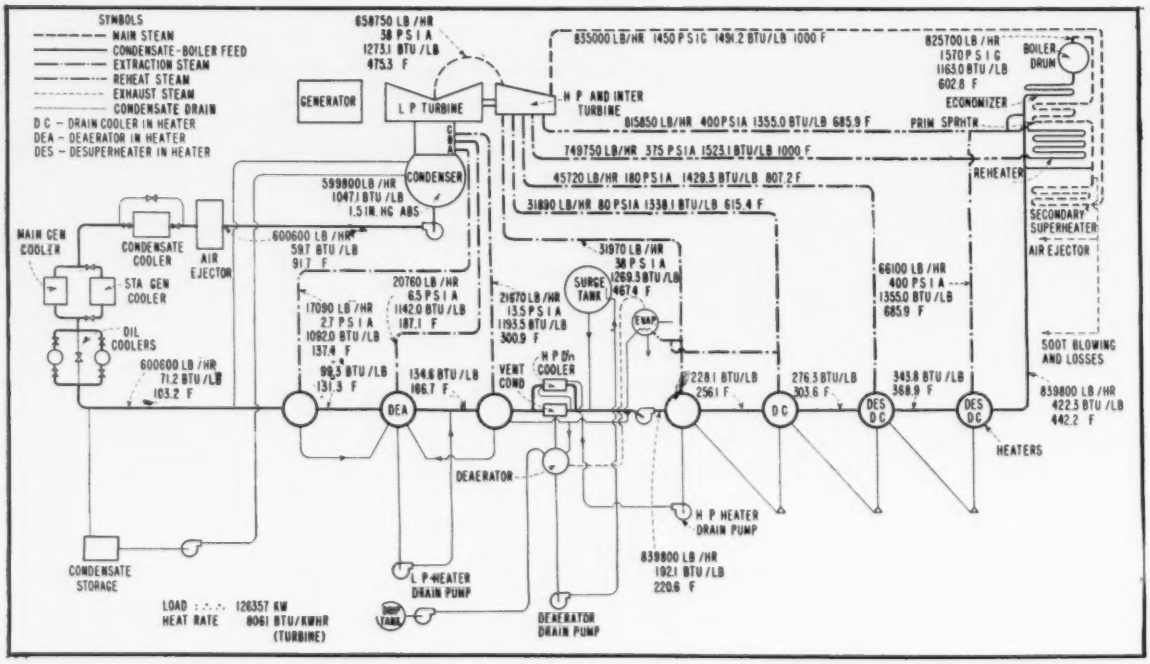
Economic generator loading is provided by the program load control interconnection with other Duquesne generating stations. Audio tones on metallic circuits are used for this load control, as well as for telemetering and signalling.

Boiler-Turbine Control Grouped . . . Control for boilers and turbines is placed between boilers in the basement. Existing No. 1 and No. 2 units are controlled from a common location with individual boards on opposite sides of the aisle. Control for No. 3 is adjacent to its boiler at the end of the building, where a future unit can be grouped with it. Both locations have high intensity louvered ceiling lighting.

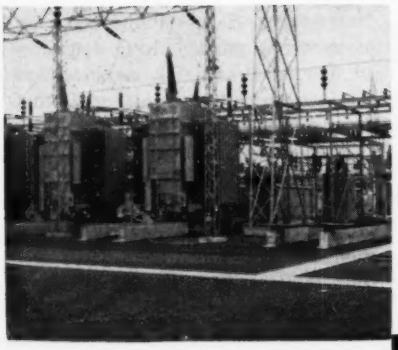
Control wiring is No. 9 and No. 12 stranded copper with 3/64-in. oil base rubber insulation and colored neoprene jacket. These conductors are cabled and covered with flame-resistant asbestos braid finish. Control power is provided by motor-generator sets backed up by a 125-v storage battery for each two units. An additional battery provides emergency power for the entire station. Control circuits are protected by air circuit breakers.

The building frame is bonded at many points to a buried copper grid in the switchyard and to sheet steel piling. Grounding buses for equipment are connected to the building frame or to the ground system itself.

Fire protection for the main generator is carbon dioxide bottles. Main and station-service transformers have emulsifier spray systems. Other general hazards throughout the plant are protected by Cardox and hose lines.


SYMBOLS
MAIN STEAM
CONDENSATE-BOILER FEED
EXTRACTION STEAM
REHEAT STEAM
EXHAUST STEAM
CONDENSATE DRAIN
D C - DRAIN COOLER IN HEATER
DEA - DEAERATOR IN HEATER
DES - DESUPERHEATER IN HEATER
658750 LB/HR 38 P S I A 1273.1 BTU/LB 475.3 F
835000 LB/HR 1450 P S I G 149.2 BTU/LB 1000 F
825700 LB/HR 1570 P S I G 1163.0 BTU/LB 602.8 F
BOILER DRUM
ECONOMIZER
PRIM SPRHTR
GENERATOR
L P TURBINE
H P AND INTER TURBINE
815850 LB/HR 400 P S I A 1355.0 BTU/LB 685.9 F
749750 LB/HR 375 P S I A 1523.1 BTU/LB 1000 F
45720 LB/HR 180 P S I A 1429.3 BTU/LB 807.2 F
31890 LB/HR 80 P S I A 1338.1 BTU/LB 615.4 F
REHEATER
SECONDARY SUPERHEATER
AIR EJECTOR
CONDENSER
599800 LB/HR 1047.1 BTU/LB 1.5 IN. HG ABS
MAIN GEN COOLER
CONDENSATE COOLER
AIR EJECTOR
STA GEN COOLER
600600 LB/HR 59.7 BTU/LB 91.7 F
31970 LB/HR 38 P S I A 1269.3 BTU/LB 467.4 F
SURGE TANK
66100 LB/HR 400 P S I A 1355.0 BTU/LB 685.9 F
20760 LB/HR 6.5 P S I A 1142.0 BTU/LB 187.1 F
17090 LB/HR 2.7 P S I A 1092.0 BTU/LB 137.4 F
21670 LB/HR 13.5 P S I A 1193.5 BTU/LB 300.9 F
EVAP
OIL COOLERS
600600 LB/HR 71.2 BTU/LB 103.2 F
99.3 BTU/LB 131.3 F
134.6 BTU/LB 166.7 F
VENT COND
H P DR COOLER
228.1 BTU/LB 256.1 F
276.3 BTU/LB 303.6 F
343.8 BTU/LB 368.9 F
SOOT BLOWING AND LOSSES
839800 LB/HR 422.3 BTU/LB 442.2 F
DEA
D C
DES D C
DES D C
HEATERS
DEAERATOR
H P HEATER DRAIN PUMP
839800 LB/HR 192.1 BTU/LB 220.6 F
CONDENSATE STORAGE
L P HEATER DRAIN PUMP
DEAERATOR DRAIN PUMP
LOAD : 126357 KW
HEAT RATE 8061 BTU/KWHR (TURBINE)

HEAT BALANCE DIAGRAM for Elrama No. 3 shows reheat to 1,000 F between high and intermediate presssure turbines, and seven steam extractions for feedwater heating. These refinements contribute to give a predicted fuel rate of 9,700 Btu per lb of bituminous coal



Factors Determining the Potential Rise in Station Ground Mats

MARTIN J. LANTZ, Branch of System Engineering, Bonneville Power Administration, Portland, Ore.

Determination of potential rise of a substation mat during ground faults on the system is complicated by many factors. These include type of substation, location of fault, effect of fault resistance, and overhead ground and neutral wires. For a general system survey it is necessary to determine for each substation maximum possible potential rise and most probable expected mat potentials based on assumed fault resistances. So many factors are indeterminate that it is difficult to predict accurately the actual voltage that will occur. Also, it is not feasible to protect for remote possibilities of high voltage.

Substation Mat Defined . . . Nevertheless, certain limits may be determined and a reasonable value obtained. The only ground current effective in raising mat potential is that actually flowing between mat and earth. A substation ground mat consists of all the physical contacts that substation equipment makes with earth. It usually comprises concrete footings and driven ground rods or a network of buried cables. Therefore, a careful study of ground current distribution must be made because some currents merely flow in the mat but do not flow to ground. Fault currents must be calculated by usual procedures based on application of symmetrical components.

Maximum possible voltage is determined by neglecting effect of ground wires or neutrals and assuming zero fault resistance for the calculation of ground current. If effective resistance of the station ground mat is appreciable, as measured by a three-point Megger system, it should be included in current calculation. Assumed fault locations should be varied, such as conductor to ground mat, conductor to earth away from ground mat, and should be applied to various voltage circuits out of the substation. The procedure is continued until the maximum resulting current that flows through the ground mat resistance is determined. This maximum current will determine the probable maximum potential rise of the ground mat to be expected.

Although this maximum current is **possible,** it is usually not **probable.** High-voltage substations generally are protected by overhead ground wires. Low-voltage stations carry neutral wires. And most faults have appreciable fault resistance, especially when fault occurs to most likely point—tower or pole. Because tower footing resistances vary over wide ranges, it

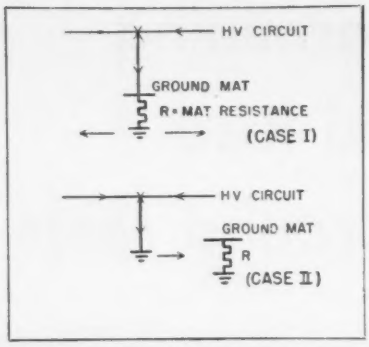


FIG 1—SWITCHING STATION under ground fault raises mat potential in Case 1 only

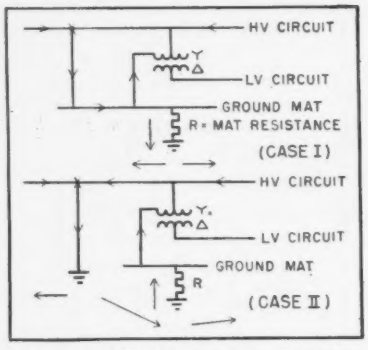


FIG 2—GROUNDED neutral transformer limits rise in Case 1, accentuates it in Case 2

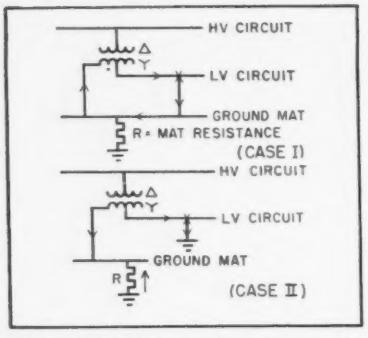


FIG 3—LOW-SIDE grounding stops mat rise in Case 1. Multi-grounded neutral limits 2

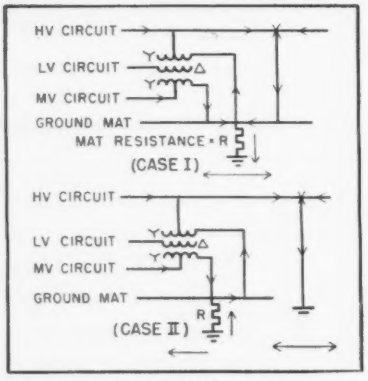


FIG 4—THREE-WINDING transformer requires study of grounded-circuit currents

is necessary to assume several values in calculating probable voltages. Resulting calculated values will give an expected voltage range that should be appreciably less than maximum possible value.

Most probable actual voltage may result from fault on an entirely different circuit from the one producing maximum voltage rise. Resistivity measurements of the area give a clue in evaluating results based on values of tower footing resistance. Footing resistances of 2, 5, 10 and 20 ohms were used in a study that was conducted by the Bonneville Power Administration system.

These assumed values cover the general range of actual footing resistances. Higher values will reduce mat potentials to negligible values. Station mat resistance is determined by plotting a curve resulting from measurements made by varying position of the inner probe in the three-point Megger method. Tower footing resistance measurements are made similarly to those for station mats except that only one position of probes is used.

Footing Resistance Affects Current . . . Limited tests and a study of actual faults on BPA's system have been made to determine the effect of tower footing resistance in limiting ground current. It was found that footing resistances of various towers vary from a few to several hundred ohms. Correlation between resistance values measured by the Megger method and values calculated during tests and faults is not too consistent. Some cases show good agreement while others show variations both higher and lower than measured values.

Except for tests, Meggered values of resistance were not made at time of recorded fault and cannot be used for direct comparisons. Data are not conclusive because footing resistances vary with wetness and character of soil or rocks around towers. It must be concluded, however, that tower footing resistance may very materially reduce ground current to a point below value computed with footing resistance neglected. Theoretical effect of fault resistance on ground current is shown in accompanying curve on the facing page.

Current Varies Between Stations . . . Distribution of ground current at different types of substations will vary as shown in accompanying diagrams. In these diagrams it is assumed that the system is grounded and that ground current flows to the fault point from system. Switching station without transformers is shown in Fig 1. In Case I, all current from fault to ground mat flows through mat to produce maximum voltage rise. Arrows indicate direction and paths of ground current flow. R represents resistance from mat to earth.

If fault occurs off the mat to ground, as in Case II, no rise will result because no current flows through mat. Ground currents flow into ground and back to system circuits through remote ground connections, such as transformer neutrals. Probability of this fault occurring to ground mat is limited because of small area of exposure involved. Nevertheless, extremely high voltages would result if the station mat resistance is found to be of a high order for any reason.

Transformer Larger, Voltage Less . . . A transformer with high-side neutral grounded is diagramed in Fig 2. A fault to the station mat, Case I, results in limited voltage rise because most of fault current returns to transformer neutral through the station mat without passing to ground through mat resistance.

Furthermore, the larger the transformer the less the voltage rise because more current is confined to mat and neutral loop. In Case II, much higher value of mat voltage results when fault occurs off the mat. All current returning to transformer neutral must pass through mat resistance. Under this condition, the larger the transformers the greater is proportion of ground current that returns to grounded neutral through mat resistance.

Aerial Ground Wire Provides Path . . . If protective overhead ground wire extends from substation in Fig 2, it forms a parallel path with ground for flow of ground currents for faults beyond ground wire area. For a fault occurring beyond end of ground wire, a steel ground wire should carry 10 to 15% of current returning to substation. Low-resistance ground wire or neutral should carry 50 to 60% of current. (Data from Engineering Report No. 37—Joint Subcommittee

on Development and Research—Edison Electric Institute and Bell Telephone System).

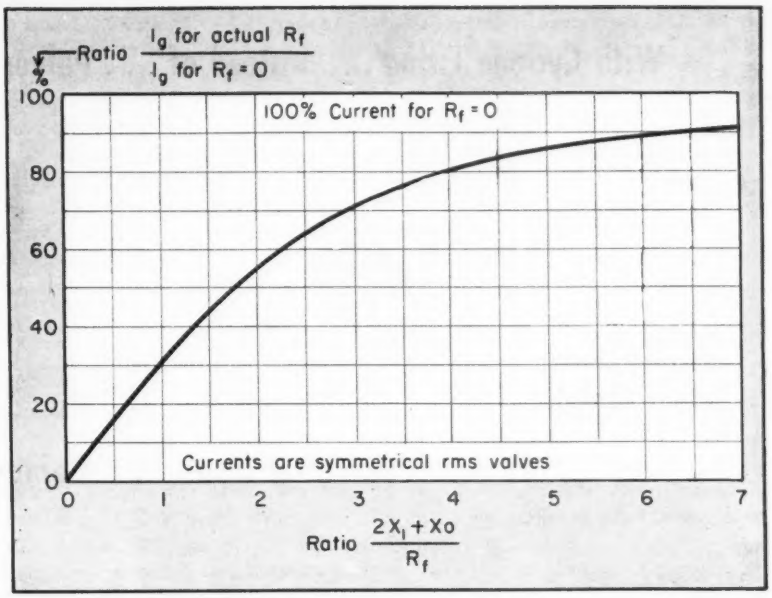
If the fault occurs on the ground wire, percentage of ground current returning over it will be a function of resistance of its contacts with ground. If insulated, all current will return through it and no mat potential rise would result.

Fault Resistance Varies . . . In Fig 3, transformer with low side connected wye and grounded has no other grounded neutrals on low voltage side. Fault from high side, either to or off ground mat, would produce same current flows as in Fig 1. Low-side fault, Case I, to ground mat would result in no rise because current would return directly to transformer neutral. For a fault off the mat, Case II, assuming that there is no neutral or ground wire, total fault current will flow through mat resistance to the neutral.

Fault resistance varies over wide limits and could be appreciable for average low-voltage wood pole line. Most stations of this type would be low-voltage wye-connected circuits with neutral wire carried with circuit. Furthermore, neutral probably would be multi-grounded. Ground current would divide between neutral wire and ground with only about 50% of ground current producing a mat potential rise.

Determine Current Distribution . . . Station with three-winding transformer is shown in Fig 4. Transformer has two windings connected wye-grounded and the third delta or is an autotransformer with grounded neutral and delta tertiary. Ground currents may pass from one wye-connected circuit to the other. For this type of substation, faults must be considered for each wye-grounded circuit to determine maximum ground current flow through mat resistance. Care should be taken to determine actual current distribution for these types of transformers.

Combinations of all types of grounding described may be found in some substations. In these cases, study of several fault locations must be made to determine maximum potential rise for a given station. Data in accompanying table show calculated potentials expected for each type of substation described.

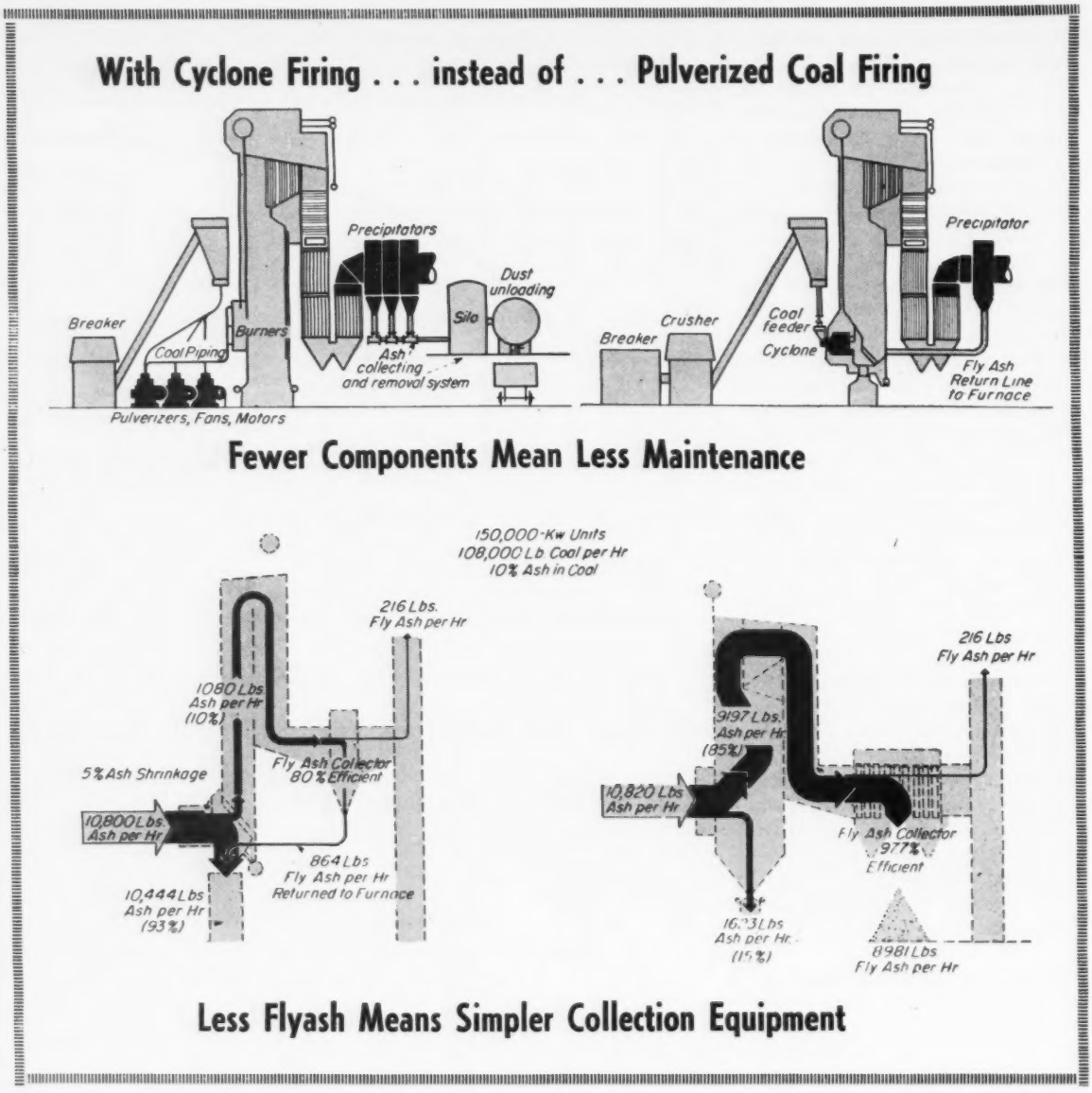


THEORETICAL EFFECT of fault resistance on ground current is based on 100% current for zero ground resistance. Tower footing resistance may materially reduce the ground current

Substation Mat Potentials Vary with Fault Resistance

Type of Station	Mat Resistance Ohms	Fault Location	Assumed Fault Resistance—Ohms 0	2	5	10	20
			Volts				
Fig 1	9.2	HV — mat	42,570	.....	.....	.....	.....
	1.45		5,410	.....	.....	.....	.....
	0.56		1,560	.....	.....	.....	.....
Fig 2	0.11		118	.....	.....	.....	.....
		HV — gnd	175	.....	.....	.....	135
	0.22	HV — mat	395	.....	.....	.....	.....
		HV — gnd	605	585	575	545	485
		MV — mat*	865	.....	.....	.....	.....
	0.50	HV — mat	1,865	.....	.....	.....	.....
		HV — gnd	410	.....	.....	.....	245
Fig 3	0.26	HV — mat	1,980	.....	.....	.....	.....
		LV — gnd	6,920	980	390	195	95
	11.7	HV — mat	10,650	.....	.....	.....	.....
		LV — gnd	7,460	6,445	5,280	4,060	2,790
	1.85	HV — mat	5,050	.....	.....	.....	.....
		LV — gnd	4,380	4,330	2,505	1,400	730
	2.67	HV — mat	8,680	.....	.....	.....	.....
		LV — gnd	3,225	1,950	1,190	710	405
Fig 4	0.25	HV — mat	1,585	.....	.....	.....	.....
		HV — gnd	595	.....	.....	.....	350
		MV — mat	1,000	.....	.....	.....	.....
		MV — gnd	2,220	1,845	1,505	980	545
	0.58	HV — mat	3,840	.....	.....	.....	.....
		HV — gnd	1,000	.....	.....	.....	615
		MV — mat	2,600	.....	.....	.....	.....
		MV — gnd	6,100	4,915	3,805	2,375	1,270
	0.34	HV — mat	2,045	.....	.....	.....	.....
		HV — gnd	520	.....	.....	.....	335
		MV — mat	2,465	.....	.....	.....	.....
		MV — gnd	3,200	2,500	1,850	1,140	600
		LV — gnd	4,955	995	435	225	120

* MV bus independent of HV bus


With Cyclone Firing . . . instead of . . . Pulverized Coal Firing
Precipitators
Dust unloading
Silo
Breaker
Burners
Coal Piping
Ash collecting and removal system
Pulverizers, Fans, Motors
Precipitator
Crusher
Coal feeder
Breaker
Cyclone
Fly Ash Return Line to Furnace
Fewer Components Mean Less Maintenance
150,000-Kw Units
108,000 Lb Coal per Hr
10% Ash in Coal
216 Lbs. Fly Ash per Hr
1080 Lbs. Ash per Hr (10%)
5% Ash Shrinkage
Fly Ash Collector 80% Efficient
10,800 Lbs. Ash per Hr
864 Lbs Fly Ash per Hr Returned to Furnace
10,444 Lbs Ash per Hr (93%)
216 Lbs Fly Ash per Hr
9197 Lbs. Ash per Hr (85%)
10,820 Lbs Ash per Hr
Fly Ash Collector 97% Efficient
1623 Lbs Ash per Hr (15%)
8981 Lbs Fly Ash per Hr
Less Flyash Means Simpler Collection Equipment

New Firing Method Cuts Power Cost

Cyclone furnace credited with reducing original investment in plant equipment and making maintenance simpler and less expensive

S. T. MacKENZIE, Sales Manager, Boiler Division, Babcock & Wilcox Co, New York 17, N. Y.

Though most other market values have spiraled higher and higher since the end of World II, utility companies have continued to hold down many basic costs. Higher steam pressures and temperatures and reheat designs together with new fuel-burning methods have helped to make this achievement possible.

In the middle twenties Boston Edison Co took the first big step in this trend when it introduced 1,400-psi steam pressure and 725 F total temperature. This increase in pressure paved the way for further increases in temperature and made reheat design practical.

Many reheat units went into operation during the late twenties. The depression stopped construction for awhile, but engineers went right on planning. The late thirties brought further increases in pressure and temperature.

Development of the cyclone steam separator in 1938 made it possible to build natural circulation boilers up to pressures of 2,700 lb. American Gas & Electric Co utilized this equipment in a unit of the Twin Branch Station which is designed for 2,650-psi, 940 F initial superheated steam temperature and 900 F reheat temperature.

Twin Branch Station was the first of the modern single-boiler, single-turbine, reheat installations, and it has been in service for 12 years. Since then many other units have been installed or ordered. Designs cover pressures of 1,300-2,700 psi, initial steam temperatures of 940-1,100 F, and reheat temperatures of 900-1,050 F.

The next step in this continuing trend was to supercritical pressure in order to take advantage of even higher steam temperatures with two stages of reheat. Such a unit is being built for American Gas & Electric Co with a design pressure of 4,500 psi, primary steam at 1,150 F, first reheat at 1,050 F, second reheat at 1,000 F. This 120,000-kw unit will replace a 40,000-kw reheat unit installed in 1923 at Philo Station on the same foundation, in the same building, with the same steel.

Firing Equipment . . . As steam pressures and temperatures have gone up, as reheat and now double reheat were introduced, gas temperatures entering the superheater have gone up in order to provide the heat required to obtain these superheat and reheat temperatures. Furnace temperatures must go up likewise. The firing method must be capable of producing them without adding to operating and maintenance problems.

The industry has seen pulverized coal firing almost entirely replace stokers because:

1 A wider variety of coals, including poorer grades, could be used.

2 Combination coal, oil, and gas firing was easier to arrange.

3 Capacity limitations on boiler size were eliminated.

4 Boiler efficiency was better through lower carbon loss and lower excess air.

5 Maintenance cost was reduced.

6 Forced outages were reduced.

7 Pressurized firing was made possible.

The higher steam temperatures and higher furnace temperatures that paralleled this development, together with other advances, led to the almost universal adoption of water cooled furnaces.

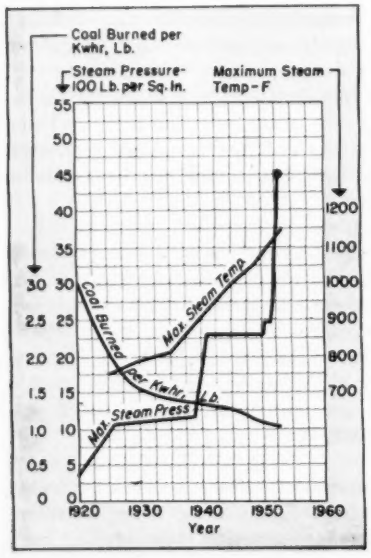
More recently, a revolutionary new furnace of unique design has made its appearance . . . the Cyclone furnace.

Cyclone Furnace . . . With normal air temperatures of 600 F this unit should operate satisfactorily on coal which has: A volatile matter in excess of 15% on a dry basis; moisture, as fired, less than 20%; ash softening temperature (reducing atmosphere) under 2,500 F; and a slag viscosity less than 250 poises at a temperature of 2,600 F. More than 70% of the 530 million tons of coal mined in this country in 1950 met these conditions and would have been suitable for Cyclone firing.

In exploring the value of this new furnace as a means of reducing the cost of a kilowatt hour, it is interesting to compare and evaluate it with a pulverized-coal-fired unit designed for eastern coals. Assume each unit under consideration is to serve a 150,000-kw machine with 1,800 psi at the throttle with 1,050 F superheat and 1,000 F reheat.

No Fly Ash Problem . . . With the Cyclone furnace the quantity of fly ash in the gases is greatly reduced. It is collected with simpler equipment, returned to the furnace, fused, and removed as disintegrated slag. The dust problem is eliminated, and savings are realized because slag is less costly to remove than fly ash. Slag can be sold for use as a coating for roofing paper, for fill, and for highway work.

When pulverized-coal firing was accepted by utility companies, it forced the simultaneous acceptance of an increase in the problem of handling ash. Compared with



Thirty Years of Power Generation Progress

Maximum steam pressures employed for power generation were about 300 psi in 1920, they increased to values over 1,000 about 1926, jumped to 2,300 in 1941, and to 4,500 in 1953.

Corresponding to this trend, maximum steam temperatures have traced a rather smooth curve upward beginning with 750 F in 1925 and attaining a level of 1,150 F in 1953.

As a result the curve showing coal burned has reflected a steady downward trend starting with 3.0 lb per kwhr in 1920 and reaching a national average of about 1.0 lb in 1953. Today's best plants are burning about 0.7 lb per kwhr.

Expectations are that the recently announced 4,500-psi, 120,000-kw Philo installation will produce 1 kwhr with 0.65 lb of coal.

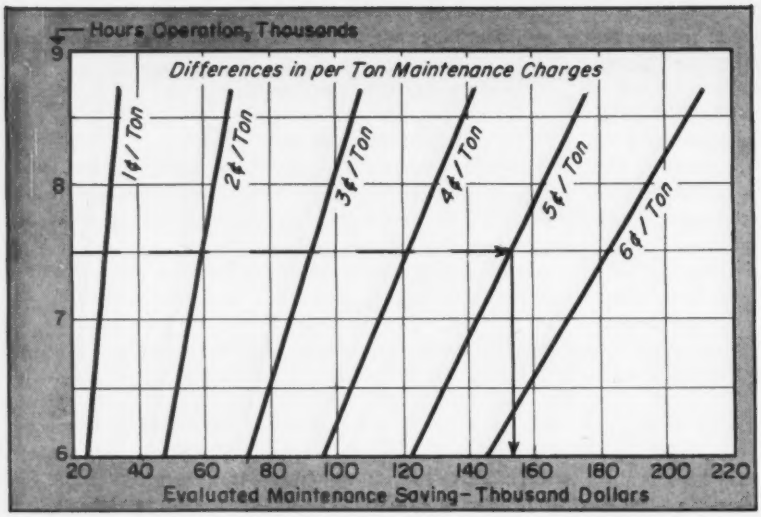


FIG 1—EVALUATED MAINTENANCE SAVINGS are shown for per-ton differences between maintenance charges for Cyclone and pulverized-coal firing. Maintenance items for Cyclones include normal servicing of furnace, feeders, and crushers. For pulverized coal they are normal servicing of pulverizers, feeders, and burners, including grinding elements of pulverizers

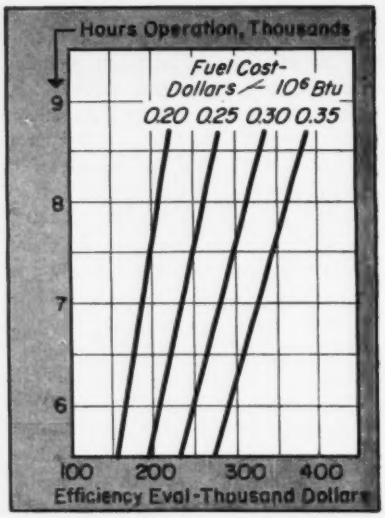


FIG 2—SAVING REALIZED on 150,000-kw unit for each 1% difference in efficiency between Cyclone and pulverized coal units capitalized at 12% is shown in the chart

Cyclone Furnaces Cut Power Cost, Simplify Ash Handling . . .

a relatively small percentage of ash mostly in cinder form going up the stack on a stoker-fired unit, about 80% of the total ash can reach the stack with pulverized-coal installations.

Then, too, cinders from a stoker-fired unit fall quite close to the plant because they are heavy; so only people in the immediate neighborhood are apt to complain. This problem is easily handled through use of a mechanical cinder trap which is relatively simple and inexpensive. In contrast, ash from pulverized-coal units spreads out over the entire community. To eliminate this nuisance, power plants installed high-draft-loss mechanical dust collectors or large expensive electrostatic precipitators, or both.

During the past 15 years, conservative estimates show an increase from 10 million to 15 million tons per year in the quantity of fly-ash collected. If power production capacity in the U. S. doubles in the next 15 years as predicted, it will be necessary to dispose of 20 million to 30 million tons of fly-ash each year.

Some part of this huge amount can be used, of course, as an admixture in concrete and as an ingredient in bitumastic roads, insulating plastic cement, and other fields. It is important to remember, however, that users of fly-ash must be relatively close to the power plant because it is uneconomical to ship this by-product any great distance.

Although a number of promising uses for fly-ash have been developed, only a small percentage is being consumed for such purposes at the present time. Most of the surplus must be hauled to a suitable dump. This operation costs the power company from 65¢ to $1 per ton.

Dust Collection Economies . . . The Cyclone furnace reduces the cost of dust collector equipment because the quantity of ash going through the boiler is greatly decreased. For this reason, to obtain the same emission from the stack, the required dust collector is only one-third to one-half as big, costs proportionally less money, and occupies a much smaller space.

Also important in the Cyclone design is the fact that collected ash is returned to the furnace. Vacuum jet dust conveying equipment including silos, cyclone separator, and dustless unloaders is entirely eliminated. Some estimates evaluate the saving thus realized at $1 per kw.

Easier Operation . . . With the size units being considered, a pulverized-coal installation would require not less than 12 burners, perhaps as many as 16. To handle the same situation, four Cyclone furnaces would be ample. Simplicity of lighting off is another Cyclone furnace advantage as each unit is complete in itself and does not depend on others for ignition.

On a four-furnace installation 25% of capacity can be dropped each time a unit is cut out. Similarly Cyclones can be run at half-capacity or less. Thus, there is an easy turndown range of at least 8 to 1 with any fuel, without fear of loss of ignition.

Lower Building Costs . . . Approximately 5% less building volume is usually required for a Cyclone unit than for a pulverized-coal-fired layout. Through elimination of many pulverizers and their massive foundations from within the building in the case sited, three $5,000 foundations will be saved, and the space can be used for other equipment. One breaker and crusher in the coal yard will serve the Cyclone installation.

Fewer Motor Foundations . . . For the size unit under discussion, a pulverized-coal-fired unit would require about 14 motor foundations for pulverizer fans, forced and

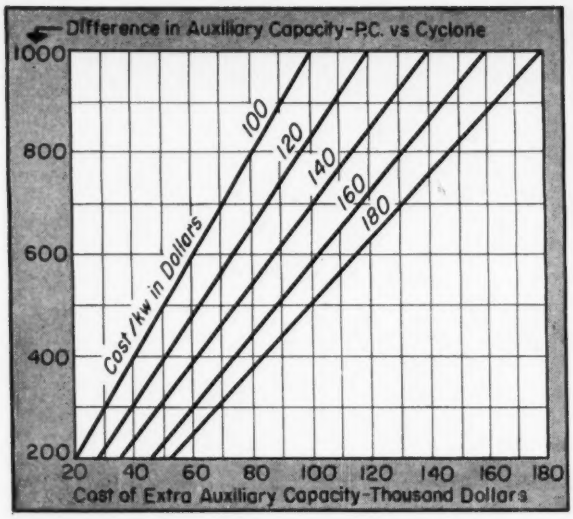


FIG 3—COST OF EXTRA AUXILIARY CAPACITY at various rates per kilowatt for possible differences in auxiliary power requirements between Cyclone furnace and pulverized-coal installations is brought out by chart. This cost is important in selecting the firing method

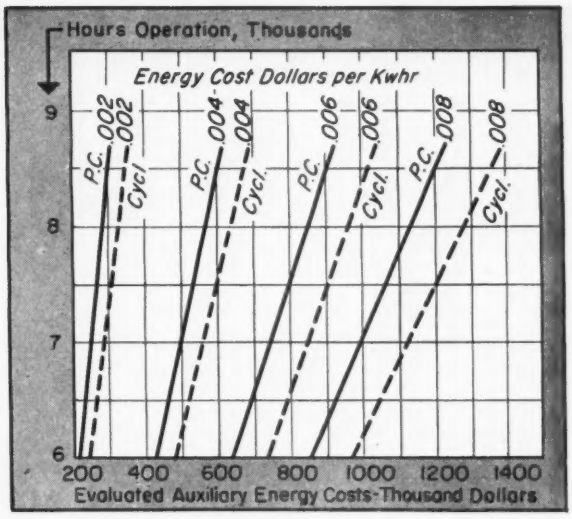


FIG 4—EVALUATED AUXILIARY ENERGY COSTS shown above include the energy consumed by all pulverizers, forced-draft fans, induced-draft fans, coal crushers, and soot blowers. These costs are based upon 12% capitalization for this type and Cyclone furnaces

And Show Increased Efficiency and Greater Adaptability

induced-draft fans, and soot blower compressors. The Cyclone unit needs only nine motor foundations; this saves five foundations and a capital investment of as much as $25,000. As fewer motors are needed, cost of electrical connections and switchgear is lowered. Again in the example cited, elimination of five motors may save as much as $25,000.

Maintenance Goes Down . . . The Cyclone furnace design makes it possible to eliminate many moving parts needed in pulverized-fuel installations. From actual experience with 20 operating units, Cyclones with feeders and crushers show maintenance costs of 1 to 2¢ per ton of coal fired. Corresponding maintenance on a pulverized-coal-fired layout runs somewhere between 4 and 10¢ a ton. Fig 1 shows evaluated maintenance savings of a variety of differences in per-ton maintenance charges for Cyclones as pulverized coal firing.

Reduced Puff Danger . . . Design of the Cyclone furnace into four self-contained units for use of crushed rather than pulverized coal virtually eliminates the danger of a puff or explosion. During years of experience with installations, experimental and test runs included, turning coal feed off and on again without ignition torches, a coal puff never occurred. With pulverized-coal, oil, or gas firing, it is estimated that at least one puff occurs in the life of every unit. Usually, such a puff means a week's shutdown.

Increased Efficiency . . . In comparing the two units previously described, it was assumed that they both operated with the same exit gas temperature. Under such circumstances, the Cyclone unit will have an efficiency slightly more than 1% greater than the pulverized-coal installation. This is true for three reasons:

1. The Cyclone operates with less excess air.
2. Carbon loss, particularly when flyash is returned to the furnace, is practically zero. It is limited to the small amount in the ash going to the stack.
3. The compressor effect of the blowers operating at approximately 60 in. of water adds about 30 F to the air temperature. This energy is recovered from that charged against the Cyclone unit in terms of power. It amounts to approximately 0.6% in efficiency.

Fig 2 shows evaluated savings for differences between pulverized and Cyclone firing for different fuel costs.

Greater Adaptability . . . Cyclone units are more readily adaptable to pressurized firing than pulverized coal because it is not necessary to provide a positive means for closing off a pulverizer if it requires maintenance during operation. Adaptability is enhanced further because ash removal is continuous and in liquid form. For these reasons Cyclone furnaces are offered without induced-draft fans, just as are oil and gas fired units. Pressurized firing, of course, provides savings through reduction in excess air and fan power and through elimination of induced-draft fans. It also makes possible improvements in efficiency and savings in power, maintenance, and space.

Auxiliary power cost may be higher with a Cyclone furnace, but the actual figure partially depends upon the kind of coal being fired. These increased costs will apply both to auxiliary demand and energy charges. Figs 3 and 4 show approximate costs for these two factors.

While it is unlikely that any single plant will realize all the possible savings from the use of Cyclone firing, it can be shown that the Cyclone pays its way through integration of the entire process of coal handling, firing, and ash disposal.

Legend

1. Parking areas
2. Pole storage
3. Training area
4. Outdoor storage
5. Truck parking
6. Covered storage
7. Salvage shop
8. Locker building
9. Warehouse
10. Meter shop
11. General shops
12. Service building
13. Transportation building
14. Administration building site

Long Island Lighting's Headquarters Built to Expand with Operating Needs

A. J. PANSINI, Manager, Meters and Distribution Engineering, Long Island Lighting Co, Hicksville, N. Y.

Service for the future, 60 acres of it, summarizes the purpose of the new electric operating headquarters of Long Island Lighting Co at Hicksville. The future is always prominent in the thinking of the management of this fast expanding company. Of its 400,000 electric

customers over 100,000 have been added in the last three years. Furthermore, no levelling off point is in sight. Home construction in the area was 19% higher in the first half of this year than in the corresponding period of 1952.

Company forecasts prior to 1950 indicated this rapid growth; so the headquarters was designed to supply twice the requirements then existing. It was estimated that the planned project would be satisfactory for 20 years. But, looking ahead provision was made in the layout so that buildings could expand either vertically or horizontally to twice their initial size.

The headquarters is a group of six buildings: Service Building, Operating Warehouse, Locker Building, Electric Meter and Test Building, Transportation Building, and General Shops. Plans call for the erection of an Administration Building, Gas Meter Shop, and a Commercial Warehouse.

When these buildings have been erected, one might say that the project will have all of the facilities needed for the efficient operation of a modern utility. Present buildings provide some 200,000 sq ft of floor area. Outdoor storage and work areas add about 300,000 sq ft. Included in this classification is a safety and training area equipped with roads and poles for the training of drivers, winch truck operators, and linemen. There is also a helicopter landing strip. Parking lots will accommodate almost 1,000 passenger cars.

Concrete roads on the property will withstand loads in excess of truck loading limits permitted by law. They are illuminated when necessary by mercury vapor street lights mounted on aluminum standards.

Location of the site was determined from analysis of the pattern of load concentration and growth, proximity to rail facilities, adequacy of roads, and the availability of land. All of these factors were important because the center was designed to provide greater coordination between the many elements of the operating forces which were scattered throughout the territory. Only operations justified on an economic basis were included.

All buildings are framed of reinforced concrete with walls built up of concrete blocks and exteriors finished in red brick. Interior walls are constructed of cinder blocks. These are painted in shop areas but finished with plaster and painted in office areas. Floors are of concrete slab construction. In office areas they are finished with asphalt tiles. Roofs are fabricated from precast slabs insulated with fiber glass. Office ceilings are lined with acoustical tile.

Utilities . . . Electric supply for the estimated 800-kw load is furnished by a 13.2-kv circuit and transformer banks totalling 1,050 kva. A second 13.2-kv circuit from another substation adds a factor of safety. Power supply for the most essential services at the center is reinforced by a 156-kva diesel-powered generator which will start automatically when both supply lines are out of service. This emergency power supply is further reinforced by a set of storage batteries which will provide lighting for the control and boiler rooms.

All buildings, except the transportation building which has its own boiler, are served by two 250-psi, 2 million-Btu-per-hr steam boilers. Either oil or gas can be burned. These boilers are located in the basement of the Service

EMERGENCY TELEPHONE CENTER provides 40 phones to answer calls from customers. At other times the room is used for meetings.

CAFETERIA location in the warehouse is only temporary, but it can serve 250 at a time. New location will be in administration building

METERS are handled here on an assembly line basis. Shop is equipped to test and repair all types of watthour meters used on the system

GENERAL SHOPS building houses carpenters, blacksmiths, painters, and machinists. Crane will handle the largest transformers now in use

WAREHOUSE has 50,000 sq ft of enclosed space. A large covered loading platform at one end of the building is used for loading trucks

Semi-Bombproof Service Building Is System Emergency Center

building. A steam radiator system in this building is supplemented by a forced air ventilating system which circulates air heated by passage over steam coils. In summer this ventilating system is utilized for air conditioning. The air is cooled by well water. Other buildings do not have air conditioning but have forced air ventilation.

Gas is available from the company's lines. Water, except for air conditioning, is supplied by city mains, and septic tanks and leaching pools serve sanitation needs.

Indoor lighting is furnished by fluorescent lamps and louvered fixtures in the offices and by incandescent lamps and fixtures in the shops.

Telephone service includes 40 central office lines for the use of customers. Five central office lines are available to the system operator. Twenty trunk lines are provided for general use. And 200 extensions on a step-by-step dial system facilitate intracompany communication.

All power lines between buildings and for outdoor lighting are underground as are the interbuilding telephone, gas, and steam heating lines.

Service Building . . . The service building houses the system operations control center (EW, Nov. 30, p 78) and boiler room on the lower level. A kitchen and sleeping quarters make it possible for key personnel to remain there for several days in case of emergency. This level is semi-bombproof. Its ceiling is 14-in. reinforced concrete with 49-in. deep reinforced beams. This construction is strong enough to sustain the collapse of the remainder of the building. The floor is 15 ft below grade.

On the first floor are facilities for emergency service operations as well as for normal construction and maintenance operations. The emergency service operators office is a separate room equipped with 40 telephone stations for receiving customer calls during severe emergencies. This room is also used as an assembly and conference room.

The second floor will eventually house the administrative offices of the various construction and maintenance groups. It is being used at present by other groups.

Operating Warehouse . . . The operating warehouse has 50,000 sq ft of enclosed space. At the east end there is a covered loading platform for servicing line trucks. This platform forms a connecting link between the warehouse proper and 65,000 sq ft of outdoor storage space which has been built up to truck bed height. At one end of this storage area a small building protects cement and other masonry materials from the weather.

A platform running the length of the outer south wall receives shipments directly from railroad cars. This platform also extends in a continuous path to the General shops. Until the administration building is erected, the project cafeteria will be in the warehouse. This can serve

OUTDOOR STORAGE SPACE has an area of 65,000 sq ft. Entire space is built up to the heighth of truck beds and is connected with the warehouse. A small building at one end of the open area is used for the storage of cement. Poles are stockpiled in an area close by

If Any Equipment Is Damaged, There's a Shop to Repair It

hot meals to 250 people at one time. It is run by an outside caterer.

Locker Building . . . Attached to the warehouse and close to the truck parking areas is the locker building. The 700 lockers for the work crews are ventilated through openings in the bottoms and doors and through an exhaust duct at the top. Other features are pay telephones and two rooms for drying wet clothing.

In this building is the ready room to which linemen report for assembly before regular working hours and where they can remain on the "alert" during emergencies. It is also used for safety meetings and training.

Meter and Test Building . . . This 27,000-sq ft building contains the meter shop, test laboratories, and the relay laboratory.

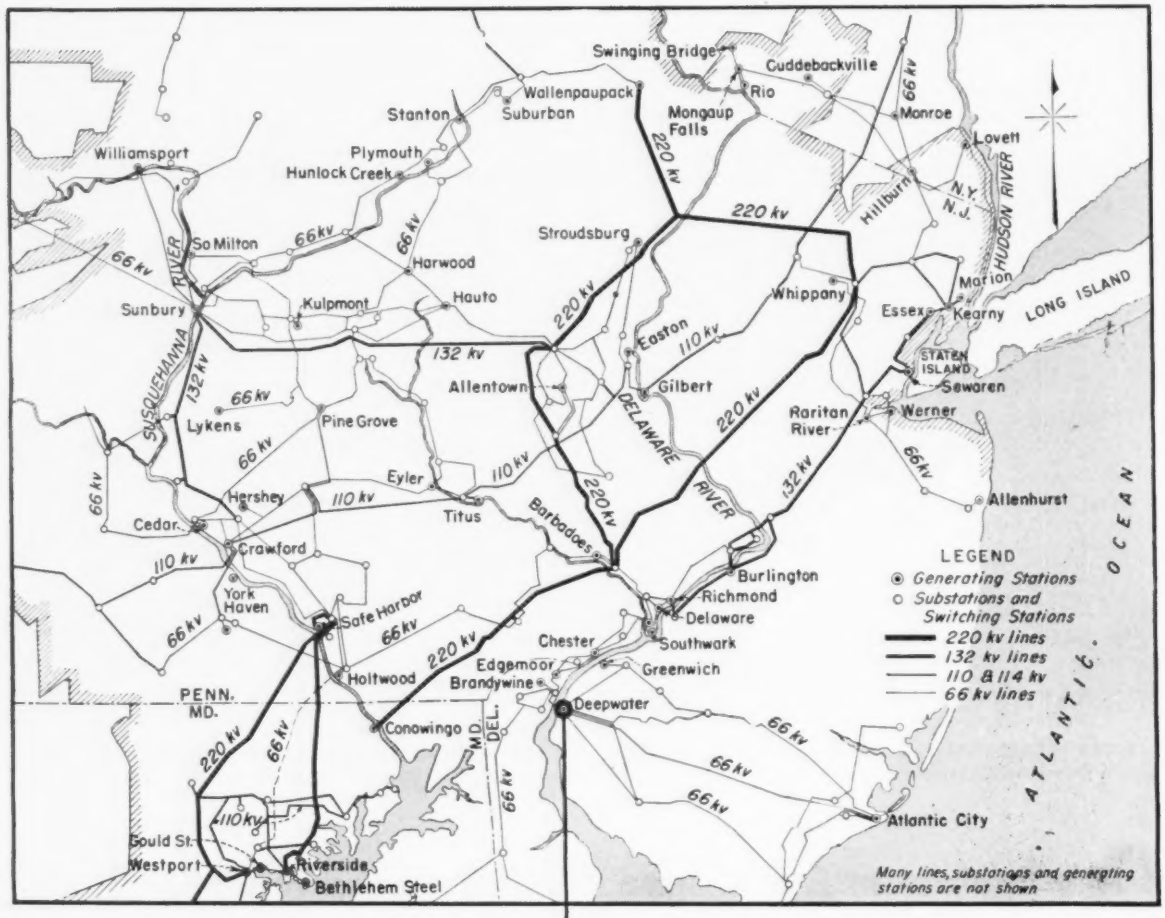
Meters are received at a storage room. From there they are removed to adjacent rooms for testing, cleaning, repairing, calibration, and final testing in assembly line operation. Then they are kept in a second storage room until needed.

The test laboratory includes a temperature and humidity controlled room for maintaining primary standards. It also has facilities for making high voltage tests up to 150 kv and current tests up to 6,000 amp. Rubber protective devices can be tested, and various electrical instruments can be tested, repaired, and calibrated. The relay laboratory repairs and calibrates all types of relays.

Transportation Building . . . Long Island Lighting has 350 vehicles working out of this headquarters and several hundred others stationed elsewhere. Vehicles are stored outdoors. The Transportation Building which has some 36,000 sq ft of covered area services vehicles at this location and provides for major repairs for all company vehicles. The main indoor repair area contains hydraulic lifts and an overhead monorail to permit under-chassis work and engine removal. All equipment needed for automotive repairs is available. Separate rooms are provided for storage of parts, repairing tires and tubes, battery and brake services, washing and drying vehicles, and painting and body repair.

General Shops . . . Included under one roof are separate rooms containing a carpenter shop, blacksmith shop, paint shop, and machine shop. A large detanking house, equipped with a 40-ton overhead crane, is at one end of the building adjacent to rail facilities. The largest transformers in use on the system can be overhauled.

A tool room for dispensing heavy construction tools, such as concrete cutters, compressors, pumps, etc, is also located in this building. A humidity-controlled room is provided for the storage of bushings.



Intertie Helps Atlantic City Electric

Interconnection Aids Utility

The Pennsylvania-New Jersey Interconnection, shown on the map at the left, comprises three member companies and ten participating companies. It supplies a zone including New Jersey, Delaware, parts of Pennsylvania, Maryland, Virginia and New York and accounts for approximately 7 million kw of generating capacity.

Atlantic City Electric Co participates in this interconnection by virtue of an agreement with Philadelphia Electric, a member company.

The type of agreement involved is described in the accompanying article by Atlantic City Electric Co. Such an agreement not only makes it possible for a relatively small company like Atlantic to install larger and hence more economical units than it could otherwise afford, but it also allows installation of such units to be deferred until economic factors are most favorable. Moreover, it provides for the company to share in savings in fixed charges resulting from interconnection that may far exceed operating savings in magnitude. Use of this type of agreement will, moreover, result in an entire pool being supplied generally by larger and hence more economical units.

Delay New Plant

W. E. CAVEN, Vice President and Chief Engineer, Atlantic City Electric Co, Atlantic City, N. J.

Participation by Atlantic City Electric Co—"Atlantic" for brevity—in the Pennsylvania-New Jersey Interconnection today permits the company to operate with a generating capacity deficit. In addition, it has made possible postponing completion of a 75-Mw turbine-generator installation for two years and so save $3 million.

By the time this 75-Mw unit is installed at Atlantic's Deepwater Station in 1954, Atlantic's load growth, supported until then by the interconnection capacity, will be sufficient to utilize new generation, and a surplus will become available to the interconnection.

Atlantic's system includes two major generating stations; Missouri Avenue Station—94.5 Mw, in Atlantic City, and Deepwater Station—106 Mw on the Delaware River. Deepwater Station until 1950 was jointly owned by Atlantic and a subsidiary of Philadelphia Electric. In that year Atlantic bought the assets of the subsidiary Deepwater Light & Power Co including its twin 69-kv interconnecting ties in New Jersey which have a total capacity of 125 Mva, continuous rating.

This purchase removed a buffer company between Atlantic and the Pennsylvania-New Jersey Interconnection. For this reason it became necessary for Atlantic to formalize an agreement with an interconnection member in order to gain for itself the advantages provided by interconnected operation. This agreement was negotiated with the nearest member, Philadelphia Electric Co, and determined, in brief for:

1. Atlantic's installed capacity obligation.
2. Atlantic's spinning reserve obligation.
3. Economy and emergency interchange arrangement.
4. Price at which Atlantic can purchase its capacity deficiency, if any.

Capacity Obligation . . . Atlantic's installed capacity obligation is the sum of its diversified peak load plus reserve responsibility. The installed reserve portion is based on the premise that if it were operating as an isolated company it would need reserves equal to its largest unit. Pooling Atlantic's generation with the interconnection represents an increased responsibility on the interconnection which is taken as 10% of Atlantic's diversified peak.

If "U" is the largest unit and "P" the annual diversified peak load, then applying the familiar split-savings principle, Atlantic's installed reserve obligation becomes ½ (U + 0.10P) and its installed capacity obligation becomes P + ½ (U + 0.10P).

The installed capacity obligation is modified by formulas designed to adjust for excessive extended maintenance outages over the year, deficiency of interconnection reserves, etc, but these will not be considered here.

Atlantic's peak load does not occur at the same period of the year as that of the Interconnection. Hence, Atlantic's peak is defined for purposes of the agreement as one-half the sum of Atlantic's maximum annual load and Atlantic's load at the time of the Philadelphia Electric Co maximum load. This again represents an equal split of savings created by the diversity in time occurrence.

It is the arrangement whereby Atlantic can purchase reserves as needed that makes possible large savings in fixed costs when used as a factor in system planning. An example of its application to Atlantic's system will demonstrate this.

Atlantic's Situation . . . Consider first Atlantic's prospective net system load when the agreement was executed. It was obvious that by the summer of 1952 Atlantic could not meet its installed capacity obligation with 200 Mw installed and its expected peak, plus reserve obligation. 208.7. Diversified peak would be 5.5 Mw less, and Atlantic would be shy about 3 Mw. This would increase each year by the amount of the system demand growth plus the incremental reserve obligation.

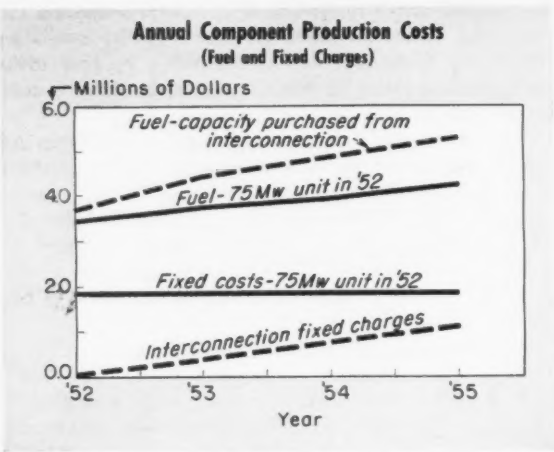
Atlantic was faced with these alternate courses:

1. Install a unit which could reasonably be supported physically and financially by 1952, or,

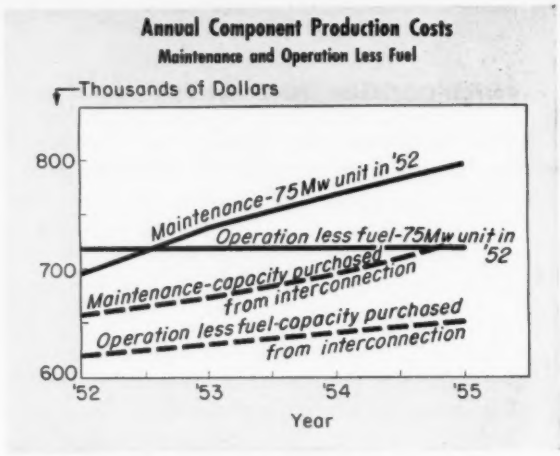
2. Plan to operate with a capacity deficit and thereby justify the installation of a larger more economical unit.

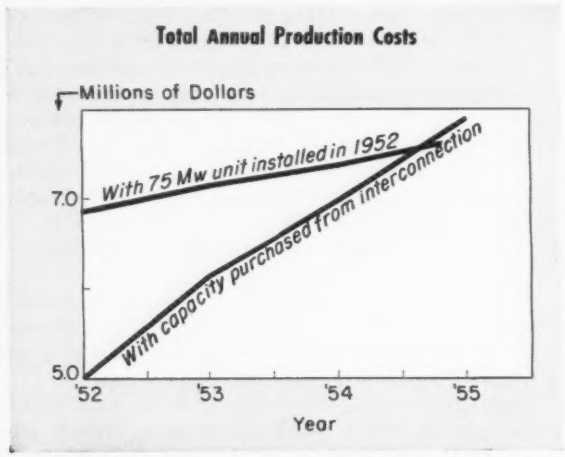
It was naturally desirable to install as large a unit as feasible because:

Adapted from paper presented before Edison Electric Institute Electrical Equipment Committee at New Orleans, La., Nov. 3, 1953

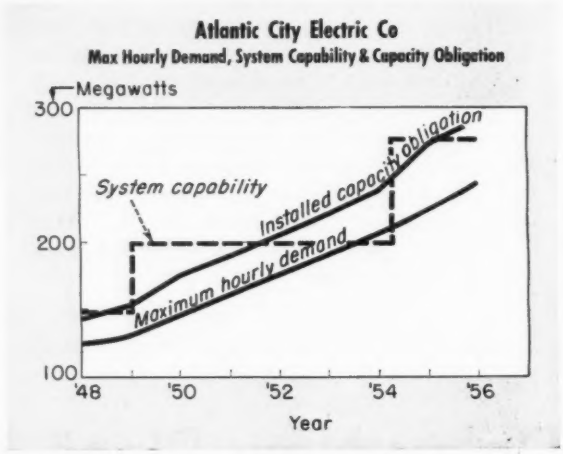


ANNUAL COMPONENT COSTS for 75-Mw unit are compared with those for capacity bought from interconnection. Included in the comparison are costs for fuel, maintenance, operation, and fixed costs. These are totalled approximately and shown below at left





TOTAL ANNUAL COSTS cover fixed and operating costs for 75-Mw unit and for the capacity purchased from an interconnection



SYSTEM CAPABILITY must be increased by 1954 to meet growing installed capacity obligation and mounting maximum hourly demand

1. Annual operating labor costs would increase about the same for either a 50-Mw or 75-Mw unit.
2. Maintenance costs per kw is higher for smaller unit.
3. Installed cost per kw is higher for smaller unit.

Accordingly the decision was to install a 60-Mw handbook machine with a continuous rating of 75 Mw. Next step was to schedule the unit to come into service in the most economical manner. This was done by plotting the total annual costs which are a function of a new 75-Mw installation by years beginning in 1952. Also on the same chart those total annual costs were plotted which are a function of the purchases from the interconnection. The intersection of these two curves represents the break-even point and dictates the in-service date of the new unit.

Annual Charges . . . The annual costs applicable are considered as:

1. Fixed costs of added investment including depreciation, insurance, and property tax. For the condition where capacity is purchased, the interconnection charges for capacity deficiency are used.
2. System fuel costs.
3. Operation less fuel.
4. Maintenance.

Fixed charges were determined at 13.6% to cover return, depreciation, property taxes, insurance and income taxes.

System fuel costs were obtained by scheduling generation for the years involved by the use of load duration curves and by calculating the system heat rate.

Operation costs, less fuel, were based on present costs plus the cost for additional operating labor.

Maintenance costs were adjusted incrementally in accordance with the required generation of all the various units.

Resultant total costs were plotted by years and are shown on the accompanying charts. The 75-Mw unit was scheduled for operation in August of 1954. Although the schedule has slipped because of delivery delays, this unit is expected to be available for service before the end of the year. Ability to purchase capacity through the interconnection will result in a saving of some $3.2 million for the three years 1952 through 1954. Economy interchange saves about $125,000 annually, it can readily be seen that saving opportunities in investment are available through interconnection agreements.

WASHINGTON COMMENT

JESSE MOCK

Old Gang, Old Story, New Names

In nearly every section of the country, organizations are springing up to oppose or cope with new federal power policy. Announced support and aims of these organizations make rather impressive reading and might give pause to any administration official trying to weigh the political impact of these new groups.

Run down the list:

In the Pacific Northwest it is the National Hells Canyon Association which was formed to fight for a high federal dam on the Snake River after Interior Department stepped out as a special pleader.

In the Missouri River Basin it is the Missouri Basin Electric Consumers Association set up to fight the new federal power marketing criteria announced by the Bureau of Reclamation.

In the Southwest it is the Southwest Power Cooperative organized to improve power supply for co-ops after Congress declined to provide funds for a huge federally operated system in that area.

In the Southeast it is the Citizens for Tennessee Valley Authority, organized to gain further federal investment in TVA.

And last week in Denver National Farmers Union attempted to add still another name to the list with its National Electric Consumers Conference. Part of the idea was to get a large block of the opposition under one nationwide banner.

Pressure to Bring Back New Deal Power Policy . . . These groups talked of court action and "kilowatt caravans" to oppose the announced federal power policies of the Eisenhower Administration. In general, their aim appeared to be to force the administration to head back toward an all-out New Deal power policy. A thesis held by several of the groups is the federal government has sort of a paternal responsibility to supply electricity to public bodies in the power business.

Now if all this activity represented a spontaneous uprising against Republican policies in the power field, it would look as if the party in power might really have to worry about survival. But a second look at these organizations trims that worry considerably.

For the most part these organizations draw support from old-line pressure groups that have backed big federal power in good weather and bad. Only one or two rely mainly on individual support. You can easily see the deft style of the National Rural Electric Cooperative Association, National Farmers Union, Tennessee Valley Public Power Association interwoven into the fabric of one or more of these "new" organizations.

The Same Old Gang Supports Same Old Policies . . . Take a look at the latest Electric Consumers Conference in Denver. You have almost exactly the same organizations participating as were in the ECC meeting in Washington in May of last year. As it turned out, the Washington meeting was entirely a political affair aimed at gaining support for New and Fair Deal power policies (EW, June 9, 1952, p 9).

In general, demands written by ECC at the earlier meeting added up to a crusading public power program tied to continuous harassment of electric companies. But in the ensuing Republican convention and in last November's election, ECC spokesmen made little headway in writing these demands into a party or administration power program.

They have been even less successful in pushing their cause under the new administration. But this has not discouraged them from helping to set up a number of these "spontaneous" organizations to keep the ball rolling.

To the extent that the old-line organizations have recruited new membership, progress has been made in their crusade. But up to now, it appears that the "new" organizations are little more than a regrouping of old members.

There can be little doubt that Republicans are playing some part in both the old-line and "new" organizations. These are not strictly politically partisan groups. But generally the same men who played the big roles in earlier public power drives are still doing most of the talking.

Job of administration officials trying to weigh the political effects of the present power controversy is to determine how much fire is behind all the belching smoke.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Switched capacitors would normally be used on circuits up to 5 kv for voltage improvement up to about 4% and supplemental regulators for improvement above 4%. Rule-of-thumb, not rigorous.

Jacketed cable is increasingly used on one system for corrosion protection because there has been no failure in 73 miles of it installed since 1941.

Aluminum in contact with any other metal in an electrical connection is almost sure to lead to trouble if a liquid electrolyte is present in the joint. Degrees of corrosion depends on the strength of the electrolyte, relative positions in the galvanic series and duration of the exposure.

Mica crystals will soon be grown artificially in electric furnaces.

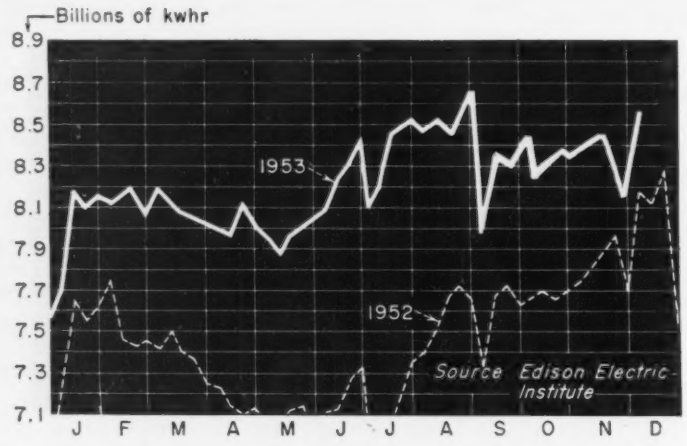
Sodium hexametaphosphate in two parts proportion with one part of soap (or synthetic detergent), all in 1% solution in water, will effectively remove radioactive contaminants from exposed surfaces.

Weed and brush removal by means of effective chemicals is cheaper and more permanent than hand removal. Subsequent treatments are progessively less costly.

Vaselines highly refined tend to dissolve Neoprene sheath materials and the adhesive coatings of tapes. They should be used with care to seal aluminum to copper connections on covered wire.

Brush and weeds seldom secure and maintain footholds in areas covered with heavy, thrifty sod of appropriate grasses.

STATISTICS



Output Week Ended Dec. 5—8,582,459,000 Kwhr

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Dec. 5	+5.1	+0.9	+0.9	−1.1	+6.5	+15.2	+3.8	+7.4	+21.0	+2.2
Nov. 28	+5.7	+3.9	+2.7	−1.2	+4.5	+17.6	+1.7	+6.9	+21.6	+0.4
Nov. 21	+5.6	+1.6	+0.8	−1.7	+4.0	+17.4	+2.7	+8.5	+24.2	+5.4

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load (Million Kw)	Sept.	77.2	77.1	69.6
Capacity (Million Kw)	Sept.	87.59	86.63	78.76
Production (Billion Kwhr)	Sept.	37.04	38.50	33.38
Hydro	Sept.	7.59	8.45	7.36
Fuel	Sept.	29.45	30.04	26.02
Fuel Consumption				
Coal (Million Tons)	Sept.	9.70	9.70	8.84
Oil (Million Barrels)	Sept.	6.16	6.55	6.05
Gas (Billion Cu Ft)	Sept.	105.30	112.88	96.38
Sales (Billion Kwhr)	Sept.	32.64	32.82	30.11
Residential	Sept.	8.55	8.48	7.66
Commercial	Sept.	5.90	5.98	5.37
Industrial	Sept.	15.67	15.83	14.75
Other	Sept.	2.51	2.52	2.33
Net Income Class A & B Companies ($ Million)	Sept.	81.17**	77.43	74.14
Estimated Dec. '53 Peak (Million Kw)	Sept.	85.6	86.2	88.0
Kwhr per Residential Customer (12 Month Average)	Sept.	2,303	2,289	2,131
Revenue per Kwhr Residential Service (12 Month Average)	Sept.	2.76¢	2.76¢	2.77¢
Canadian Production (Billion Kwhr)	Sept.	5.09	5.09	4.99

Business Statistics

FRB Industrial Production Index†††	Oct.	236	236	233
Gross National Product Annual Rate ($ Billion)	3rd Qtr.	369.0	372.4	345.3
EW 5 Industry Production Index	Oct.	127.6	128.3	127.4
ENR Construction Cost Index††	Nov.	128.1	128.0	123.4
BLS Consumer's Price Index	Oct.	115.4	115.2	114.2
NEMA Insulation Materials Sales Index†	Sept.	153	153	142
NEMA Electric Appliance Sales Index†	Sept.	101	90	105
NEMA Household Refrig. Sales Index†	Sept.	62	63	69
Metal Prices (Dec. 8)				
Copper, Conn. V., lb		$.29-.30	.29-.30	.24¼
Lead, N. Y. lb		.13½	.13½	.14
Zinc, prime Western E. St. Louis, lb		.10	.10	.12½
Tin, Straits, qual. N. Y., lb		.85½	.82	1.21½
Aluminum, ingot, base price		.21½	.21½	.20
Nickel, base price		.60	.60	.56½
Steel, billets, Pitts., ton		62.00	62.00	59.00
Steel, scrap, No. 1 heavy, Pitts., ton		36.00	36.00	46.00

*Preliminary **Revised †1947-49=100 ††1949=100 †††Unadjusted

New Equipment Buying Continues Upward Trend

Postwar buying of new equipment by private business has been high and promises to stay high, according to data released by the Department of Commerce's Office of Business Economics. The last few years have seen a tripling and quadrupling of the dollar volume reported in 1929, the first year considered in the department's trend study. In 1951 and 1952, equipment purchases reached 22 billion dollars, and preliminary indications are that the '53 figure will be even higher. In physical volume, average yearly purchases are about double those of 1929.

Durable Equipment Purchases

	Volume—Millions Constant 1947 Dollars	
Product Group	1929	1952
Furniture & Fixtures	471	683
Fabricated Metal Products	185	298
Engines & turbines	85	204
Tractors	203	730
Agricultural	346	844
Machinery:		
Construction	169	468
Mining & oil-field	239	585
Metalworking	346	872
Special-industry	608	1,209
General industrial	643	1,154
Office & store	209	671
Service-industry & household	265	823
Electrical	529	2,463
Trucks, buses, trailers	853	1,900
Cars (for business)	1,635	2,573
Railroad Equipment	623	807
Instruments	88	496
Miscellaneous	271	360
Total	7,768	17,140

Although expansion has been taking place in all phases of production equipment, the major increases have been in machinery, where purchases in electrical machinery, instruments, construction, mining, and metalworking machinery are at least five times what they were in 1929.

The long range view reveals further that production equipment outlays have an increased share of the total fixed capital. In the twenties, equipment and non-residential construction investment were roughly the same—between 5 and 6% of total output. During the postwar period equipment rose to about 6½% while construction declined to 3%.

Some of the factors stimulating equipment investment have been the high volume of output, postwar defense needs, and technological advances. The latter has also meant the development and introduction of equipment for producing new kinds of products.

Iowa-Illinois Rates Change

Company will earn a 5.8% return on its electric properties on the basis of fair value while gas department will earn 5.95%

In a lengthy decision which again confirmed Illinois Commerce Commission's adherence to the Illinois "fair value" principle, the ICC found a 5.8% return on the fair value rate base of $25 million for the electric properties in Illinois of the Iowa-Illinois Gas & Electric Co. At the same time it reduced the gas rates by $250,000 on the grounds that the gas department was earning a 7.7% on its fair value rate base and reduced its allowable return to 5.95%.

Property Allocation . . . Although the ICC discussed at some length the allocation of the company's total property to its business in Illinois, it came to no definitive conclusion when it said:

"However, the controverted allocations questions are complex and difficult and it is not necessary in order to dispose of this case to settle them. Whichever allocations theory is adopted, the proposed electric rate increase appears to be justified. The ICC will therefore make no final determination with respect to such allocations.

"In the following discussion as to rate base, we present figures using the company's basis of allocations and figures using the staff's basis of allocations with respect to Western Iowa generating and transmission plant."

In determining the rate base of the company, the decision said:

"It is our statutory duty to fix rates which are just and reasonable and which, under the decisions of the Supreme Court of Illinois, provide a reasonable return on the basis of the present fair value of the utility's property used and useful in rendering its service to the public. Consideration must be given to current economic conditions, present price levels, and reproduction costs as well as original construction and capital addition costs and the probable earning capacity of the utility under the rates thus fixed. **Illinois Bell Telephone Co** vs **Illinois Commerce Commission** 414 Ill. 275."

In arriving at the fair value of the Illinois District rate base, the ICC considered original cost per books, original cost less depreciation, reproduction cost new, and reproduction cost new depreciated.

Working Capital Trend Reversed . . . As regards working capital, the ICC reversed a trend which had been developing for some time with regard to the use of tax accruals for working capital by reverting to the old procedure of using materials and supplies plus certain allowances for operating expenses in determining the working capital. The decision reads:

"The balance of the working capital requirements [i.e. in addition to M&S] is made up of an allowance for operating expenses, purchased gas, and purchased power, and prepayments and working funds. The total working capital requirements claimed by the company are reasonable and accordingly will be added to the above set out property valuations in establishing the proper rate base."

The fair value rate base of $25 million, which is applicable to the Illinois District electric plant, is some 34% in excess of the net original cost as determined by the ICC. In its consideration of revenues and expenses, the ICC disallowed a portion of the expenses for purchased gas from the company's gas department to be used as boiler fuel in the electric department. It commented:

"The company's gas department delivers natural gas to the company's electric department for boiler fuel and 'charges' such electric department the same for such fuel as it charges all outside interruptible customers, thus making the same profit out of sales to itself as it does to other interruptible customers. In 1952, 10.6% of the Illinois District's gas revenues were derived from the company's sales of interruptible gas to itself. Whatever paper profit exists in the sale of interruptible gas thus made by one branch of the company to the other results in undue burden to the electric department of the company and undue benefit to the gas department, while not affecting the company's actual operating results."

The amount allowed was based on the average of pipe-line companies charges excluding any return on investment on the distribution system of the gas department.

Depreciation . . . As regards depreciation for rate-making purposes the company claimed that:

". . . in arriving at just and reasonable rates its depreciation expense should be computed on reproduction cost at Jan. 1, 1950, price levels on inventory of June 30, 1953."

The ICC rejected the company's contention by pointing out its order in the People's Gas Light Co case wherein it said that depreciation accruals cannot be based on reproduction cost. The decision went on to say:

". . . the present Uniform Systems of Accounts stand as controlling for Illinois gas and electric utilities unless some specially cogent reason for change in a particular situation appears. The record herein is devoid of such reason and on the contrary indicates that the company has been able to meet its replacement requirements out of currently available funds."

As regards regulatory expenses, the ICC, after making certain adjustments, allowed this to be amortized throughout operating expenses over a 5-year period.

Rate of Return . . . In regard to the rate of return, the ICC received testimony from Edward Hopkinson and R. H. Tinsman, company witnesses.

Hopkinson testified that with respect to a fund it is assumed "to be equal to the present fair value of the company's Illinois property, invested equally in the securities of 39 companies (non-utility) including 10 industrials, eight banks, seven food product companies, five tobacco companies, and nine chain store companies." According to his testimony, such a fund so invested would, after payment of federal income taxes, 'return' to its owner for the year 1951,

6.38% and for the year 1952, 6.27%."

The ICC went on to say:

"This evidence was presented, according to the company, to give the ICC the sort of evidence that the Supreme Court of Illinois discussed in **Peoples Gas Light Co** vs **Slattery,** 373 Ill. 31, 68, where the court said:

'It seems to us fair to assume that if the company could take a sum equivalent to the value of the property and invest it soundly, so as to insure a rate of return in excess of its return authorized by the commission, this would be proof, or at least evidence, of confiscation, yet we are bound to take judicial notice of the fact, as well as evidence in the record, that it would be exceedingly difficulty to invest a sum anywhere comparable to the value of appellee's property so as to earn 5%.'"

Tinsman, who is the company's secretary-treasurer, testified that in his opinion the reasonable rate of return on the present fair value of the company's Illinois electric property was 6.5%, the one-half of 1% representing an allowance of rewarding efficient management. He said he believed that 6.25% represented the cost of capital to the company for its entire Illinois District but that 6% would be the cost of capital for the Illinois electric business because he felt a combined gas and electric business had a greater risk than the electric alone.

ICC's witness, Frederick Kleinman, testified that in his opinion the rate-making process should reflect the decline in the cost of money to the utility just as much as it should reflect the increase in the cost of construction. And on such a basis a fair rate of return on the fair value of the company's Illinois electric property would be not more than 4.8% and on the fair value of its Illinois gas property would be not more than 4.62%. These returns would be adequate to maintain the integrity of the company's investment and permit the company to raise additional common stock money without dilution.

The commission, in arriving at the rate of return to be allowed for the Illinois properties, said:

"It appears from the record that after allowing the increase in the electric rates requested by the company the rate of return will not be more than 5.8% on a fair value of

(*Continued on page* 227)

Today in Utility Finance

YIELDS (%)

Quality	Bonds 1st	Bonds 2nd	Bonds 3rd	Preferred Stocks 1st	Preferred Stocks 2nd	Preferred Stocks 3rd	Common Stocks 1st	Common Stocks 2nd	Common Stocks 3rd
DATE 1953									
Dec. 3	**3.11**	**3.17**	**3.38**	**4.19**	**4.37**	**4.65**	**5.13**	**5.54**	**5.68**
Nov. 25	3.10	3.17	3.38	4.17	4.37	4.65	5.18	5.60	5.74
END OF QTR.									
3rd 1953	3.30	3.33	3.54	4.35	4.52	4.83	5.36	5.97	6.01
2nd 1953	3.34	3.46	3.64	4.47	4.70	4.88	5.52	5.93	6.10
1st 1953	3.15	3.23	3.39	4.16	4.41	4.66	4.95	5.24	5.50
4th 1952	2.99	3.03	3.15	4.06	4.22	4.59	4.98	5.33	5.62

Data: Reis & Chandler, Inc.

EARNINGS

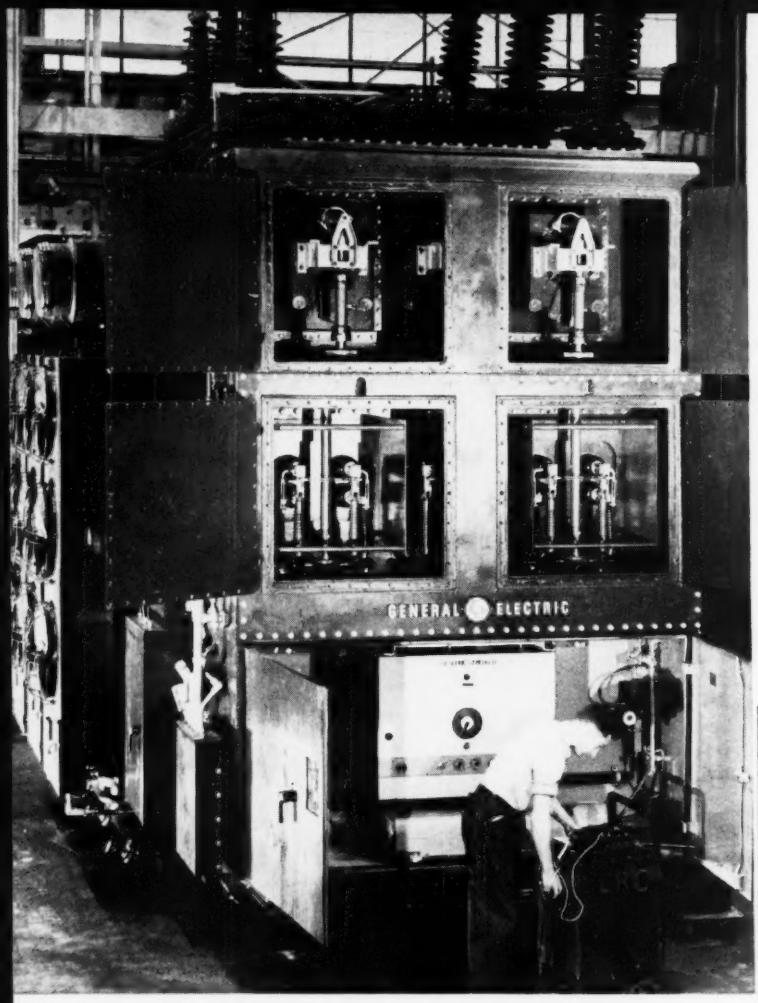
Company	Period Months Ended		Net Income 1953	Net Income 1952	Earnings Per Common Share 1953	Earnings Per Common Share 1952
Arkansas Power & Light	12	Oct.	$7,219,540	$6,015,526	$....	$....
Citizens Utilities	12	Sept.	867,000	764,000(a)	.98	.87
Dayton Power & Light	12	Sept.	6,996,094(b)	6,837,826(b)	2.71(b)	2.67(b)
Mississippi Power & Light	12	Oct.	4,372,009	3,724,260	....	....
Ohio Edison & subsidiary	12	Oct.	18,717,085	15,537,014	3.05(c)	2.86(c)

Note—(a) Adjusted to include the applicable 1952 portion of the increase in revenue resulting from the Vermont Public Service Commission's decision of Dec. 24, 1952; (b) Earnings for common stock and based on 2,579,120 shares in 1953 and 2,565,344 shares in 1952; and (c) Based on 5,278,306 shares in 1953 and 4,798,460 shares in 1952.

FINANCING

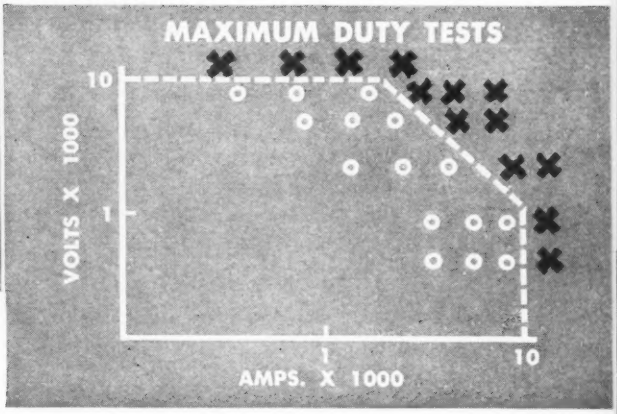
Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF DECEMBER 3-9			
Bonds			
Imperial Irrigation District, Calif—electric revenues due 1957-84	$10,000	various	(a)
Debentures			
Quebec Hydro-Electric Commission—3½% due 1978	$50,000	99.1759%	3.55%
Preferred Stock			
Duquesne Light—100,000 sh 4.20% $50 par	$5,000	$51.21	4.10%
SCHEDULE FOR DECEMBER—JANUARY			**Bid Date**
Bonds			
Philadelphia Electric—1st mtg due 1983	$20,000	.....	Dec. 10
Nashville, Tenn—electric revenues due 1957-84	3,000	.....	Dec. 15
Salt River Project, Ariz., Agriculture & Improvement & Power District—electric revenues	5,000	.....	Dec. 17
Appalachian Electric Power—1st mtg due 1984	20,000	.....	Jan. 11
Public Service Co of Indiana—1st mtg due 1984	25,000	.....	Jan. 12
Consolidated Edison Co of New York—1st mtg due 1984	35,000	.....	Jan. 12
Ohio Edison—1st mtg due 1984	30,000	.....	Jan. 19
Central Illinois Electric & Gas—1st mtg	4,000	.....	.....
Upper Peninsula Power—1st mtg	1,000	.....	.....
Debentures			
Detroit Edison—debs (to be offered commonholders on the basis of $100 principal amount of debs for every 25 shares of common held)	$43,358	.....	.....
Preferred Stock			
Narragansett Electric—150,000 sh $50 par	7,500	.....	Dec 16
Central Illinois Electric & Gas—15,000 sh $100 par	1,500	.....	.....
Common Stock			
Consumers Power—679,436 sh (to be offered commonholders on a 1-for-10 basis, record Jan. 7 to expire Jan. 22; employees will be given right to unsubscribed shares)	$.....	.....	.....
Ohio Edison—527,830 sh (to be offered commonholders on 1-for-10 basis, record Jan. 14 with an oversubscription privilege)	.....	.....	.....
Upper Peninsula Power	500	.....	.....
POSTPONED, UNSCHEDULED, AND/OR UNDER CONSIDERATION			
Bonds			
Southwestern Public Service-1st mtg	$12,000(e)	.....	.....
Houston Lighting & Power—1st mtg	25,000	.....	.....
Public Service Co of Colorado—1st mtg	15,000	.....	.....
Brazos River Authority, Tex.—electric revenues	66,000	.....	.....
Central Illinois Electric & Gas—1st mtg	4,000	.....	.....
Utah Power & Light—1st mtg	16,000(e)	.....	.....
Preferred Stock			
Southwestern Public Service	$3,000(e)	.....	.....
Common Stock			
Iowa-Illinois Electric & Gas	$6,000(f)	.....	.....
Southwestern Public Service—about 272,000 to be offered on 1-for-14 basis)	.....	.....	.....
Utah Power & Light—about 225,000 sh	.....	.....	.....

Notes—(a) To yield from 2.20% to a dollar price of 99 for the 3½% of 1984; (e) Estimated; and (f) To sell enough common stock to yield $6 million.



FINAL TESTS on control wiring are made prior to shipment. Large, hinged doors, re-usable Nitrile rubber gaskets, and roomy compartments simplify field inspection and maintenance.

No need to worry if a short circuit occurs during a tap change



G-E Load-Ratio-Control operates successfully even under maximum short-circuit duty

If a system short circuit occurs while a tap change is under way, General Electric Load-Ratio-Control is designed to complete the operation successfully . . . *even under the maximum short-circuit duty to which the transformer may be subjected.*

Contactor interrupting tests, made during the design of each standard LRC mechanism, assure you of dependable operation. Oscillograms of each test shot record the current and voltage values and the arcing time. These points are plotted on a logarithmic chart like that shown above. Points showing excessive arcing time are recorded as crosses. Satisfactory tests are recorded as circles. A line enclosing area of satisfactory performance under short circuit defines the range of normal application of contactor.

From such test data, G-E transformer designers are furnished an application chart for each standard equipment that shows the range of transformer ratings to which the equipment can be applied.

Remember too, that in G-E load-ratio-control, the four design factors: insulation life, arcing-tip life, mechanical life and short-circuit duty are all *co-ordinated* to give you good service, longer periods between inspection and less maintenance.

For full information on G-E Load-Ratio-Control, contact your nearest G-E Apparatus Sales Office, or write General Electric Company, Section 421-7, Schenectady 5, New York.

You can put your confidence in—

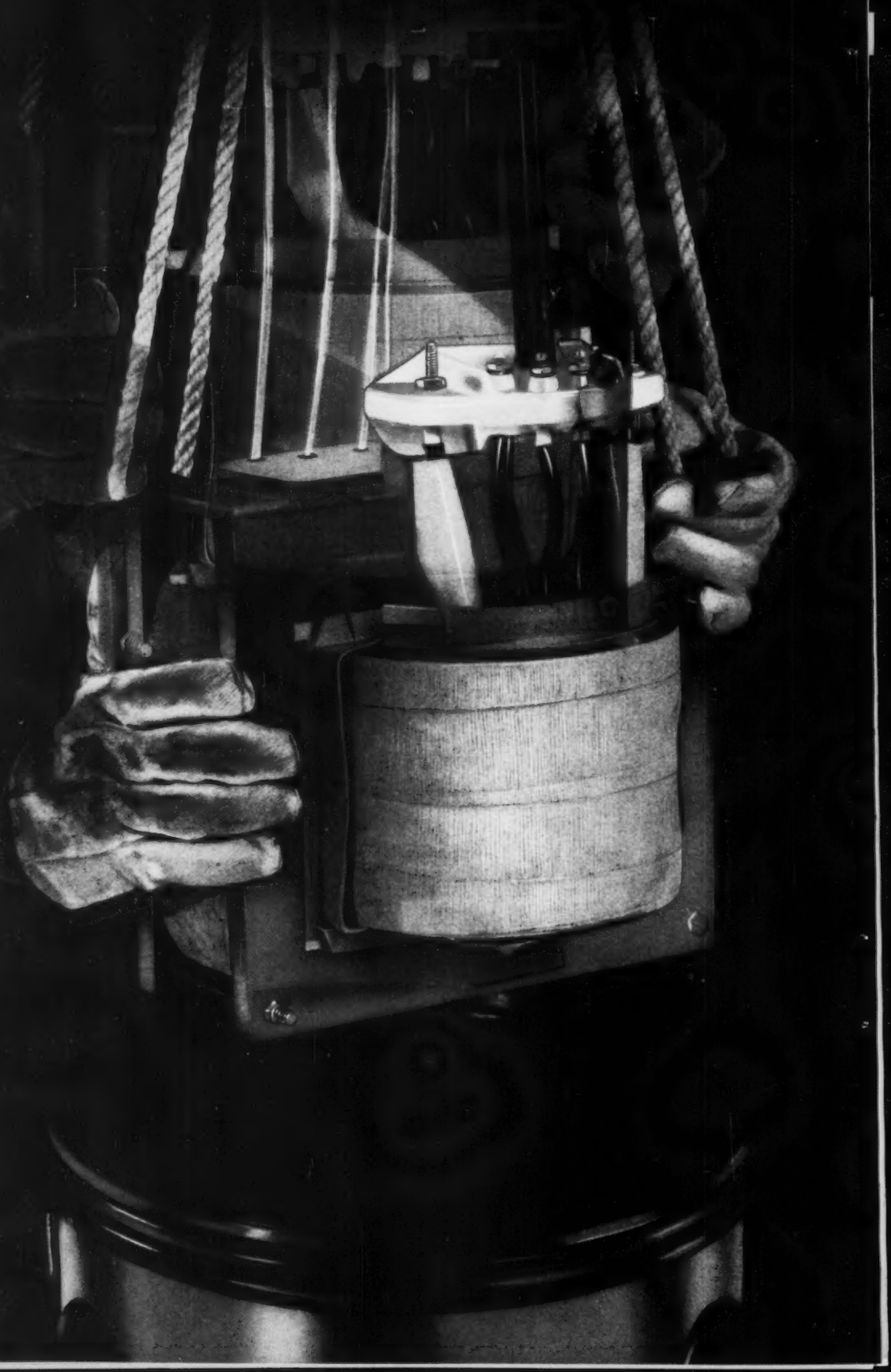
GENERAL ELECTRIC

APPARATUS SERVICE SHOPS

Atlanta, Ga.
Baltimore 30, Md.
Boston, Mass.
Buffalo 11, N. Y.
Charleston 28, W. Va.
Charlotte, N. C.
Chicago 80, Ill.
Cincinnati 2, Ohio
Cleveland 4, Ohio
Columbus 15, Ohio
Dallas 9, Texas
Denver 5, Colo.
Detroit 2, Mich.
Houston 20, Texas
Johnstown, Pa.
Kansas City 8, Mo.
Los Angeles 1, Cal.
Milwaukee 3, Wis.
Minneapolis 12, Minn.
New York 14, N. Y.
Philadelphia 23, Pa.
Pittsburgh 6, Pa.
Portland 18, Ore.
Richmond 24, Va.
St. Louis 10, Mo.
Salt Lake City 4, Utah
San Francisco 3, Cal.
Seattle 4, Wash.
Toledo 4, Ohio
York, Pa.
Youngstown 5, Ohio

DISTRIBUTION TRANSFORMERS

different from others because.....



....Nationwide service facilities *keep your transformers "on the line"... provide day and night emergency or quick reconditioning service*

Whether a sudden storm brings chaos to your system, or repair work piles up . . . here's the simple, easy way to get your inactive transformers of any make back "on the line" . . . faster.

NATIONWIDE SERVICE FACILITIES, through General Electric service shops, are as near as your telephone (see list of cities at left). Burned out core-and-coils can be replaced, or your 1½- and 3-kva transformers can be up-rated to 3 or 5 kva, or in some cases 7½ or 10 kva. Special equipment, genuine factory parts, and trained personnel assure prompt service and top performance.

REMEMBER... all transformers are not alike . . . compare the General Electric plus features in the chart below and see for yourself.

For more information on distribution transformers, either unit-type or conventional, contact your nearest G-E sales office, agent or distributor, or write to General Electric Company, Section 431-10, Schenectady 5, New York.

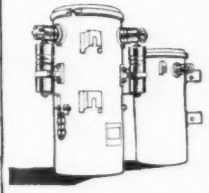
You can put your confidence in—

GENERAL ELECTRIC

ALL TRANSFORMERS ARE NOT ALIKE

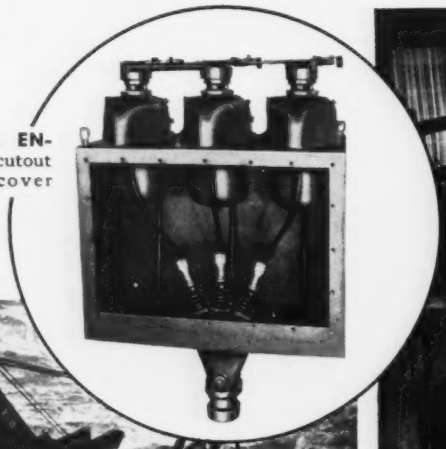
(make this simple comparison and see)

FEATURE	General Electric	Mfr. A	Mfr. B	Mfr. C	Mfr. D	Mfr. E
Production-line impulse testing	YES	NO	NO	NO	NO	NO
Nitrile rubber gaskets at all tank openings	YES	NO	NO	NO	NO	NO
Strenicor pressure terminal clamps	YES	NO	NO	NO	NO	NO
Insulated clamp-type connectors on tank wall hv bushings	YES	YES	YES	NO	YES	YES
One-piece cover band	YES	NO	NO	NO	NO	YES
Terminals designed for both copper and aluminum conductors	YES	NO	NO	NO	NO	NO
Gapped valve-type arresters	YES	NO	NO	NO	NO	NO
Nationwide company-operated service facilities	YES	YES	NO	NO	NO	YES

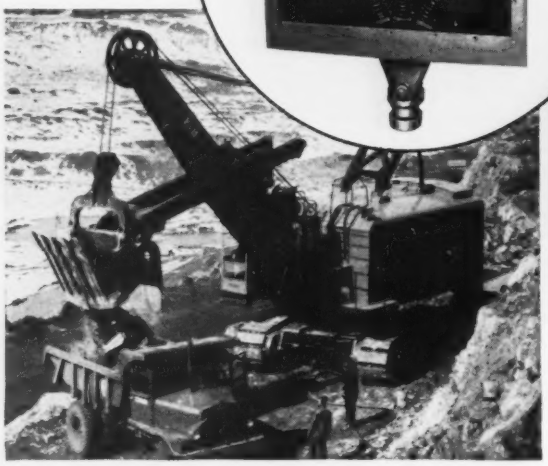


UNIT-TYPE CONVENTIONAL

"Take your choice G. E. makes both"



3-PHASE METAL ENCLOSED oil fuse cutout assembly, with cover panel removed.



UNIVERSAL INTERNATIONAL PICTURES CORP. studios at Universal City, Calif., here shown filming "All American" starring Tony Curtis, use both single-phase and 3-phase G-E oil fuse cutout assemblies in their Editorial Building vault.

P & H ELECTRIC SHOVELS (manufactured by Harnischfeger Corp., Milwaukee, Wis.) are equipped with G-E oil fuse cutout assemblies for short-circuit protection of electrical equipment where greater safety, minimum space and ease of operation are so essential.

Electric shovel or movie studio . . . both use G-E oil fuse cutouts for low-cost switching

Metal-enclosed assemblies, gang-operated, provide maximum personnel safety, neat appearance and service dependability

Wherever the job of overcurrent protection is coupled with the need for some load switching, General Electric oil fuse cutout assemblies combine both functions with greater safety of operation, long life and low cost. Their high interrupting rating (up to 11,000 rms amperes), long contact life, and quiet, almost noiseless operation, make them the ideal fusing device where installations must be made indoors or in working areas. They may be wall or direct-to-equipment mounted.

Metal-enclosed assemblies of G-E oil fuse cutouts, either single or three-phase, provide a neat appearance —all wiring and electrical connections completely enclosed in a grounded steel cabinet, factory assembled for easy, fast installation. Just connect the unit, fill the cutouts with oil, and insert fuse link or disconnect blade. Such cutouts can also be furnished for mounting on steel skids which make them ideal for portable protection in mines, oil fields, naval yards, etc.

G-E oil fuse cutout features include:

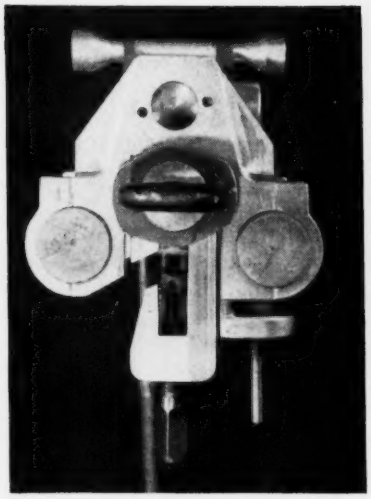
- **No expansion chamber required for full interrupting capacity**
- **Simple re-fusing, even on gang-operated assemblies. Pre-formed fuse links easily slip into place**
- **Silver-plated, heavy forged copper contacts with special arcing tips . . . minimize wear**
- **Leads brought into cutout housing above oil level—no gasketed joints under oil pressure**

G-E oil fuse cutout assemblies are ideal for utility, industrial, commercial and institutional use within the range of 2400 through 7200 volts.

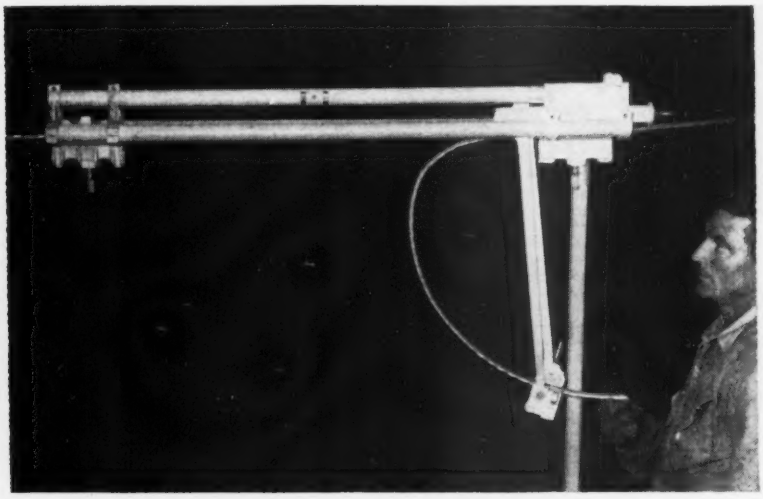
For full details, contact your nearest G-E Sales Representative or write for Bulletin GEC-863 to General Electric Co., Schenectady 5, N. Y. 433-2

You can put your confidence in—

GENERAL ELECTRIC



CLAMPING JAWS accommodate No. 6 through 4/0 and grip without nicking wire



SWINGING ARM attachment grips dead conductor and locks in open position to provide up to 32-in. clearance. Upon release arm aligns conductor ends for connecting operation

"Sectionalizing" Tool Speeds Work on Hot Lines

FLOYD H. HANSON and LESTER J. GEARHART *
Lone Star Hot Line Tool & Service Co, Forth Worth, Texas

New hot-line tool has been developed to speed work on energized lines up to 45 kv where cutting of a conductor is involved, without interrupting service on the line. This tool, for temporary selectionalizing, is known as "Time and Life Saver". It may be used in installing or removing overhead equipment, cutting and repairing storm breaks, replacing faulted sections of line, and resagging energized conductors.

The tool and method of use were developed and tested during a 3-year period. In tests on cutting in or removing air-break switches, the hot-line tool and a crew of four saved 50 to 75% of the time formerly required by a crew of nine to twelve men using considerably more equipment.

The tool weighs approximately 18 lb. It consists of a frame of three treated, laminated wood poles on which are mounted three clamping means—fixed, movable, and intermediate units. Movable clamp is positioned and driven through a ratchet along a gear track and also allows for locking the clamp at any point on the track. Clamp may be slacked or ratcheted through distance of 6 in., allowing use of connectors up to 11 in. long. An additional movable clamp unit may be installed to give a working distance up to 12 in.

Intermediate clamp unit is mechanically connected to movable clamp so that they both move together. Attached at the intermediate clamp is a swinging arm attachment that moves out from the frame and can be latched in open position. Upon release of latch the arm automatically swings back to proper alignment between fixed and movable clamps.

Jaws within each clamp grip the conductor more tightly should it tend to slip. Slots in clamps facilitate attaching the tool on conductors. Hot-sticks may be used to place or remove the hot-line tool, position movable clamp and swinging arm, and tighten clamping jaws.

For work on three-phase lines, six Time and Life Savers are required, plus three high-voltage jumpers, two hot-sticks, a working platform, and an auxiliary alley arm. After platform and alley arm are in position, jumpers are connected to each phase conductor about 12 ft out each way from pole or structure involved. Alley arm holds jumpers at safe spacing between phases.

Two hot-line tools are placed on each conductor with movable clamp end closest to the pole, and clamping jaws are tightened. Movable clamp then is moved inwardly to provide slack for cutting the conductor. One end of the cut conductor is swung away from a tool by the swinging arm attachment. Intermediate clamp grips the conductor so that it is bowed without kinking or bending sharply. Swinging arm then is locked in open position to provide an air gap up to 32 in. between cut ends of conductors.

After each phase wire has been cut twice and swinging arm locked open on both sides of section, grounding wires are attached and work may be completed safely and bare-handed. In reconnecting line section, compression or automatic connectors are attached to dead end of conductor before swinging arm is released to its original position. Movable clamp is positioned so that live conductor may be placed in connecting device and section energized. Clearances on tool allow use of a variety of connector sleeves.

Movable clamp is backed off to place strain on conductor, after which clamps are loosened and hot-line tools are removed from all phase conductors. Removal of high-voltage jumpers completes the work

*Prior to application for patent on device, both authors were linemen with Tucson Gas Electric Light & Power Co, Ariz.

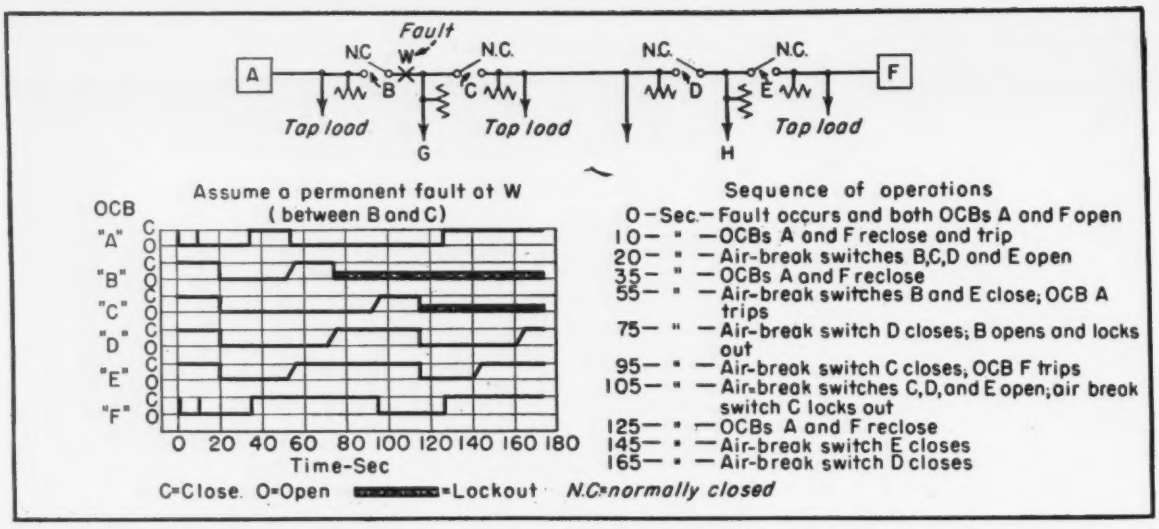

Fault
W
N.C.
N.C.
N.C.
N.C.
A
B
C
D
E
F
Tap load
Tap load
Tap load
G
H
Assume a permanent fault at W
(between B and C)
OCB
"A"
"B"
"C"
"D"
"E"
"F"
C O
0 20 40 60 80 100 120 140 160 180
Time-Sec
Sequence of operations
0 - Sec. - Fault occurs and both OCBs A and F open
10 - " - OCBs A and F reclose and trip
20 - " - Air-break switches B,C,D and E open
35 - " - OCBs A and F reclose
55 - " - Air-break switches B and E close; OCB A trips
75 - " - Air-break switch D closes; B opens and locks out
95 - " - Air-break switch C closes, OCB F trips
105 - " - Air-break switches C,D, and E open; air break switch C locks out
125 - " - OCBs A and F reclose
145 - " - Air-break switch E closes
165 - " - Air-break switch D closes
C=Close. O=Open =Lockout N.C.=normally closed

FIG 1—SWITCH OPERATING DATA for four stations is presented in the chart (lower left), which replaced written description (lower right). The chart gives an over-all picture so that operating personnel can rapidly determine operating sequence of equipment

Operating Charts Simplify Switch Sequence Data

C. T. OLDER, District Relay Engineer, Appalachian Electric Power Co, Charleston, W. Va.

T. S. MICHAELS, Relay Section, American Gas & Electric Service Corp, New York, N. Y.

Two charts showing different ways of indicating predetermined automatic airbreak switch operating sequences have been developed to aid load dispatchers and relay men of the American Gas and Electric system. Both charts present in simple form the operating sequences of switches that would occur to isolate a faulted line section. With these charts, operating personnel can rapidly determine in what order equipment should function. They also aid relay men fo layout new operating schemes.

Both charts were prompted by the increased number of motor-operated sectionalizing switches and replace written material describing the operating sequences. The latter description did not give operators a quick over-all picture of what was happening and difficulty was experienced in coordinating written representation with fault conditions.

Designed for showing sectionalizing sequence in a four station scheme, the chart in Fig 1, which has fulfilled operating and design requirements, replaces the word description at its right. Similarly, shorthand tabulation in Fig 2, which separates equipment into two groups at fault point, also presents switching sequences relatively clearly for switches around one station and replaced a written description of operating sequences.

Additional information to that shown in both figures is necessary for operating and relay personnel to properly understand electrical control of switches. This information includes notes for each switch that "pins down" what equipment and associated potentials cause switch operations. Such information is shown on one-line diagrams. In itself, this information could be used to determine switching sequnces but it would be even more difficult to follow than the written description in Fig 1.

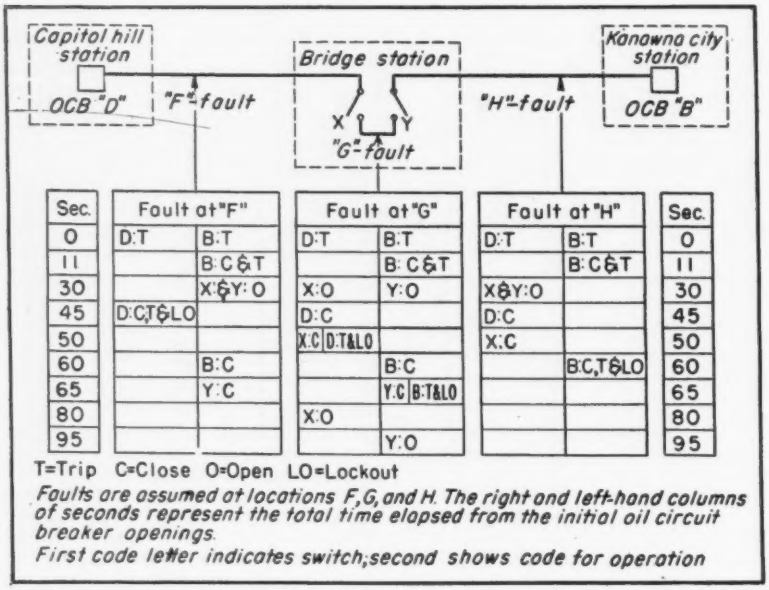
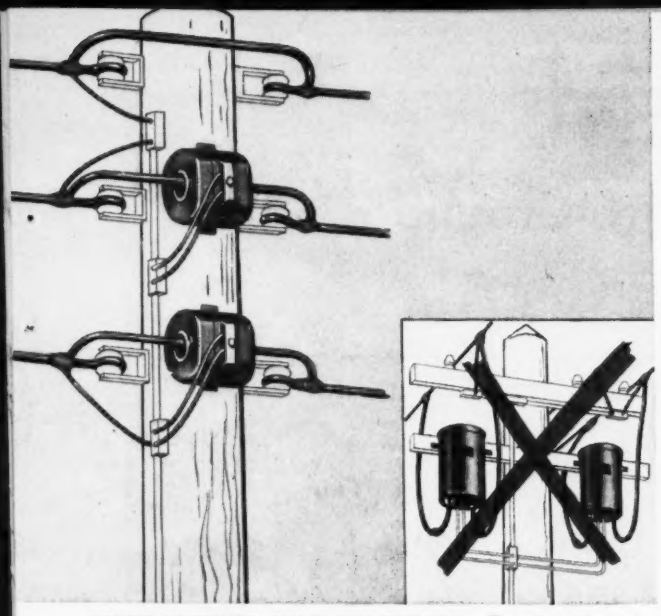
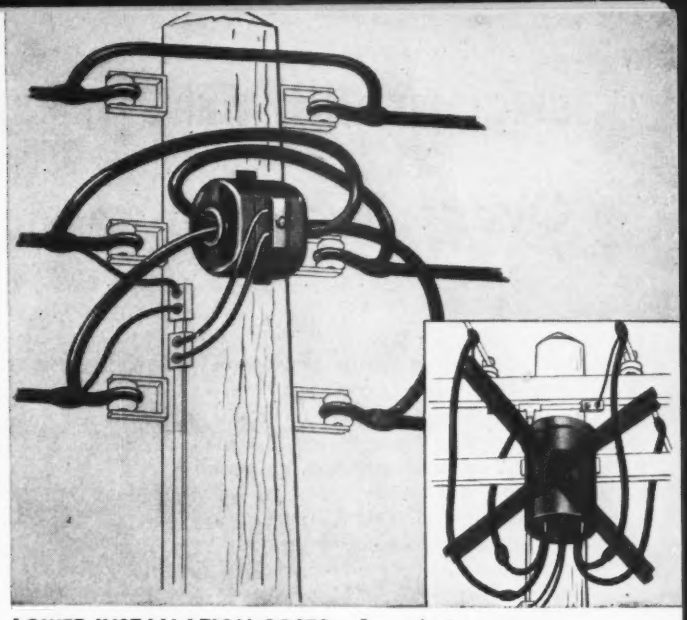

Capitol hill station
OCB "D"
"F"-fault
Bridge station
X
Y
"G"-fault
"H"-fault
Kanawha city station
OCB "B"
Sec.
Fault at "F"
Fault at "G"
Fault at "H"
Sec.
0 D:T B:T D:T B:T D:T B:T 0
11 B:C&T B:C&T B:C&T 11
30 X:&Y:O X:O Y:O X&Y:O 30
45 D:C,T&LO D:C D:C 45
50 X:C D:T&LO X:C 50
60 B:C B:C B:C,T&LO 60
65 Y:C Y:C B:T&LO 65
80 X:O 80
95 Y:O 95
T=Trip C=Close O=Open LO=Lockout
Faults are assumed at locations F, G, and H. The right and left-hand columns of seconds represent the total time elapsed from the initial oil circuit breaker openings.
First code letter indicates switch; second shows code for operation

FIG 2—SHORTHAND TABULATION for operating sequence at one station also replaces a cumbersome written description. Equipment is divided into two groups at fault point



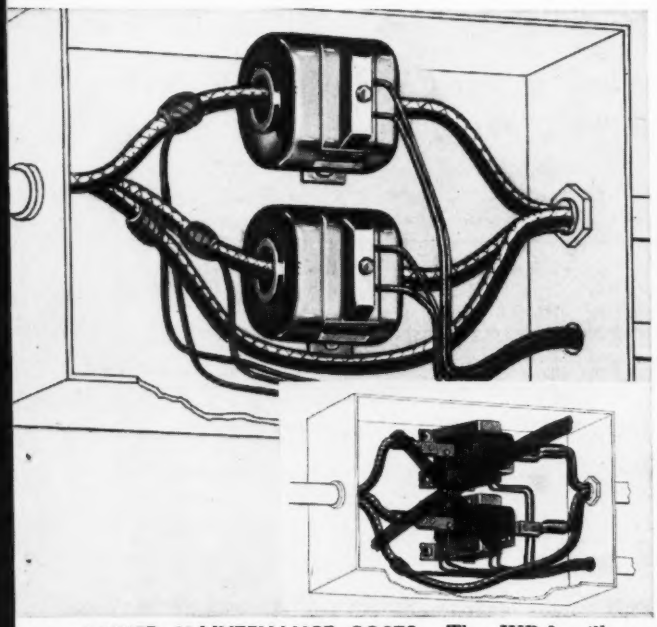
BUTYL-MOLDED, WINDOW DESIGN. Butyl makes the transformer attractive and easy to install; window makes wiring easy. JKP-0 easily replaces standard Type JKB-2.



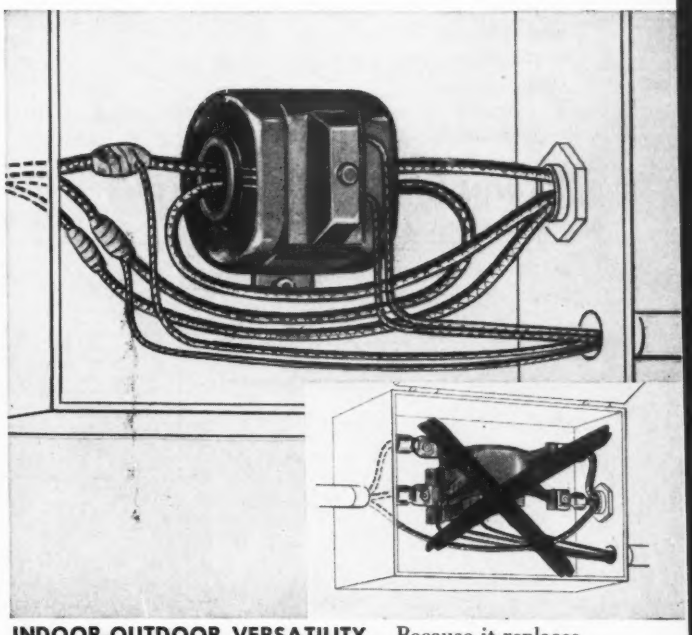
LOWER INSTALLATION COSTS. In replacing some conventional standard transformers (above: JKB-1) the JKP-0 eliminates need for crossarms, hanger connections, etc.

4 in 1

NEW G-E CURRENT TRANSFORMER REPLACES 4 STANDARD MODELS



LOWER MAINTENANCE COSTS. The JKP-0 will not corrode, breakage is reduced, no painting is needed—due to butyl construction. Above: JKP-0 replaces G-E Type JL-1.



INDOOR-OUTDOOR VERSATILITY. Because it replaces many other types, the JKP-0 cuts stock and inventory costs. Here the butyl-molded JKP-0 replaces the Type JKR-1.

(604-36)

Write or call your nearest G-E Apparatus Sales Office, or authorized agent or distributor. Ask for Bulletin GEA-5874. General Electric Co., Schenectady 5, N. Y.

GENERAL ELECTRIC

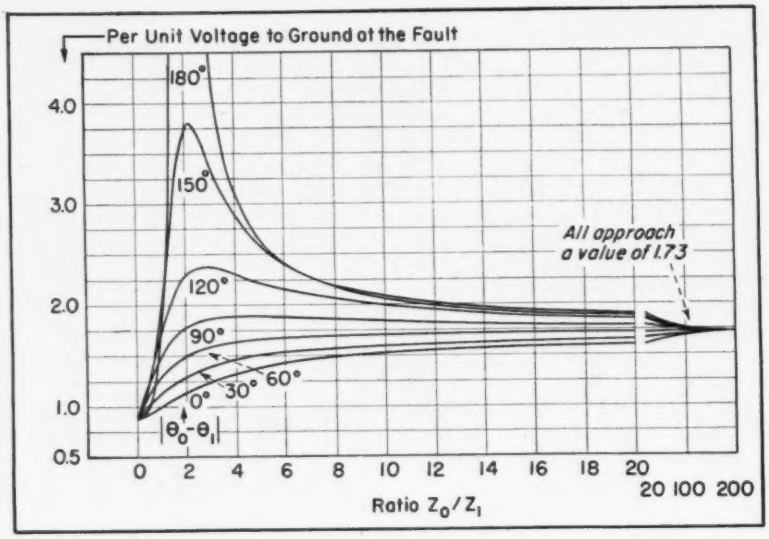
Overvoltage During Line-to-Ground Fault

D. P. INWOOD, Electric Utility Application Engineer, General Electric Co., Dallas, Texas

Accompanying chart provides a simple method to determine the overvoltage resulting from a line-to-ground fault. It covers the range of possible system impedance for both grounded and ungrounded systems. In addition it may aid in application of lightning arrestors to protect equipment from transient overvoltages.

The chart gives the higher voltage to ground that may be expected on two unfaulted phases with a ground on the other phase of a three-phase circuit. This higher voltage is a function of Z_0/Z_1 and $|\theta_0 - \theta_1|$ and is expressed in per unit of system voltage to ground that exists at time of fault.

In deriving curves, assumptions made are: fault impedance = 0; and positive and negative sequence impedances are equal, i.e., $R_2 = R_1$ and $X_2 = X_1$. Therefore, it is necessary to know only positive- and zero-sequence impedances at the fault point. An example shows how the chart can be used.

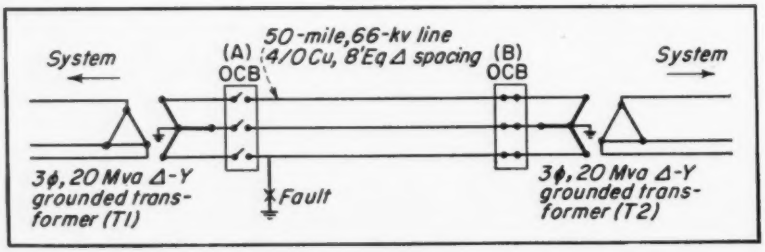


OVERVOLTAGE expected on two unfaulted phases as result of a line-to-ground fault

Example for Use of Chart

Refer to the diagram. Impedances on 20 Mva base, for the system components, are:

Transformer ($T1$): $X_1 = 7.5\%$; $X_0 = 6.5\%$
Resistance neglected
Transformer ($T2$): Same as transformer ($T1$)
66-kv Line: $X_1 = 17.2\%$; $R_1 = 6.35\%$
$X_0 = 66.6\%$; $R_0 = 12.85\%$
System: $X_1 = 1.5\%$; R_1 is neglected
$X_0 \rightarrow \infty$; $R_0 \rightarrow \infty$



Solution

With circuit breaker at "A" open, positive and zero sequence impedances at the fault are:

$$Z_1 = R_{1\text{-line}} + j\,(X_{1\text{-line}} + X_{1\text{-transf.}} + X_{1\text{-system}})$$
$$= 6.35 + j\,(17.2 + 7.5 + 1.5)$$
$$= 6.35 + j\,26.2$$
$$= 26.9\ \underline{/76.4^\circ}$$

$$Z_0 = R_{0\text{-line}} + j\,(X_{0\text{-line}} + X_{0\text{-transf.}})$$

(Note—System is isolated from zero sequence path by delta connection)

$$= 12.85 + j\,(66.6 + j\,6.5)$$
$$= 12.85 + j\,73.1$$
$$= 74.1\ \underline{/80.1^\circ}$$

Then the ratio Z_0 to Z_1 is:

$$Z_0/Z_1 = 74.1/26.9 = 2.75$$

And the absolute value of $\theta_0 - \theta_1$ is:

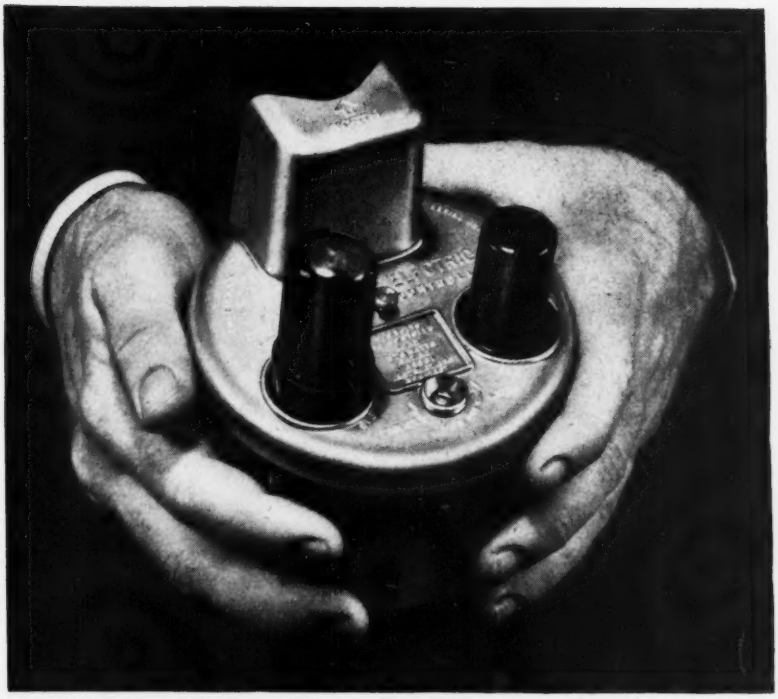
$$|\theta_0 - \theta_1| = |80.1 - 76.4| = 3.7 \text{ deg}$$

From the chart the higher of the two unfaulted phase voltages is found to be 1.24 times the voltage that existed before the fault.

Result

Therefore, if voltage at the time of fault was 66 kv line-to-line, then the voltage to ground during the fault is:

$$66/\sqrt{3} \times 1.24 = 47.2 \text{ kv}$$



NEW CONTROL ELEMENT is used in the Type P Photoelectric Control and the Form 110 Luminaire shown at right. Its plug-in design permits convenient field servicing. New element is interchangeable with G-E photoelectric controls already in service.

TYPE P CONTROLS provide sensitive, low-cost photoelectric control of series or multiple outdoor lighting circuits.

FORM 110 LUMINAIRE combines Type P control and standard optical systems in one compact unit for multiple circuits.

New G-E Photoelectric Street-lighting Controls

Provide reliable service longer, need less maintenance, cost less

General Electric makes both separate photoelectric controls and complete photoelectric luminaires. Both now use an entirely new control element with an etched-circuit and dip-soldered connections. These new manufacturing techniques make possible a better, more accurate photoelectric control at a lower price.

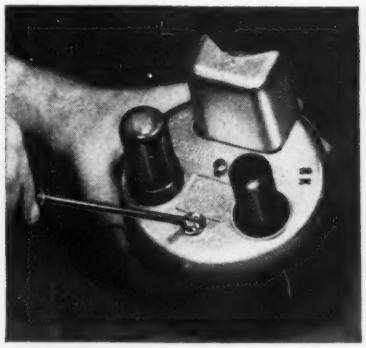
G-E photoelectric controls give you light whenever its needed, regardless of the time of day. Power consumption is low, and the circuit design assures maximum tube life. The controls do not require adjustment while in service, and need no attention after power failures.

The new units are completely interchangeable with G-E photoelectric controls already in service. Enclosed in a standard glass meter cover for protection against physical damage, the control element plugs in, permitting replacement of the unit without reorientation.

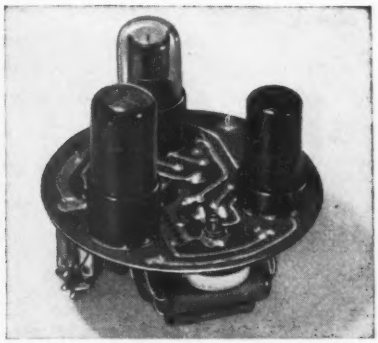
For more information see your nearest G-E Apparatus Sales Office or Authorized Agent; or write for Bulletin GEA-5141 to *Section 452-136, General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

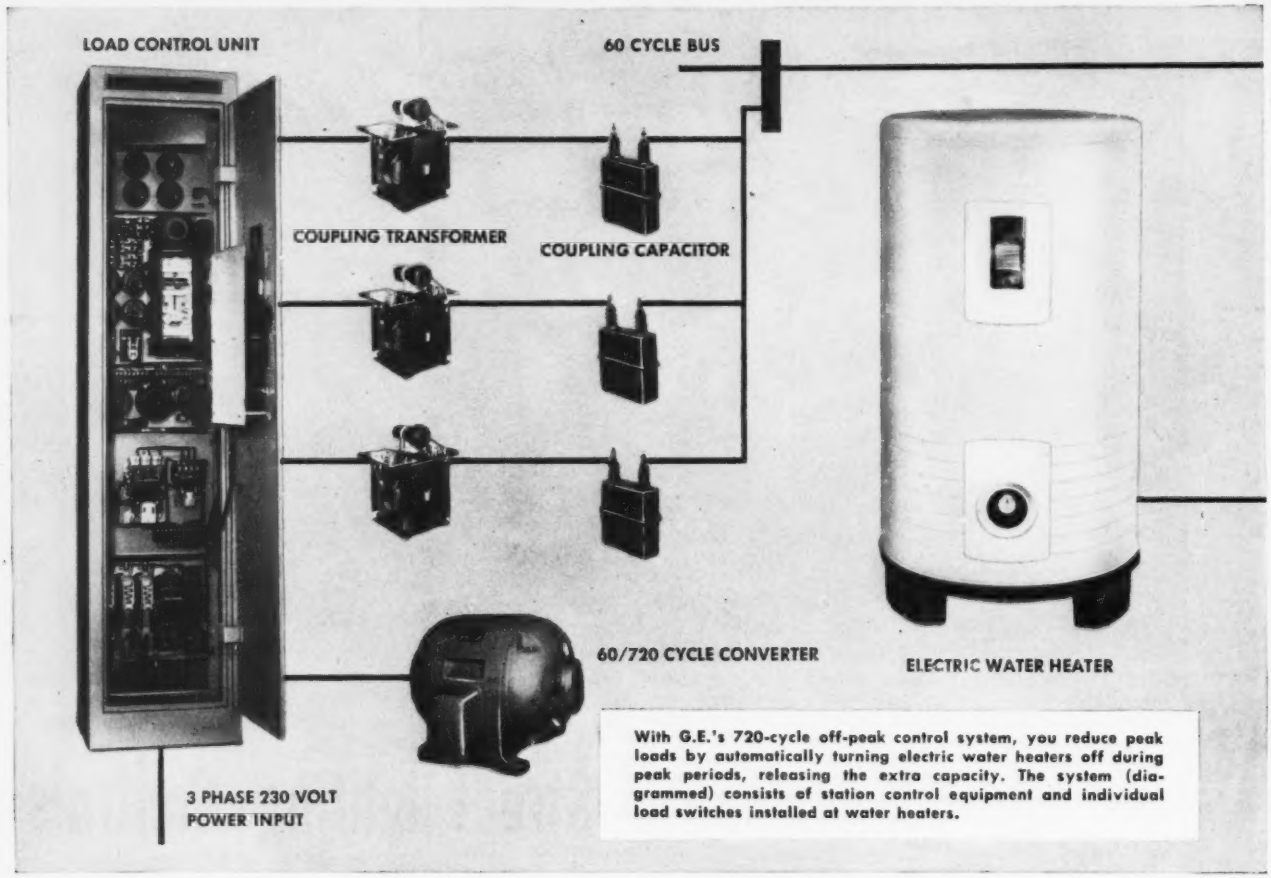
ORIENTING GUIDES assure proper alignment of control element in receptacle, permit replacement without reorientation.



OPERATING LEVEL can be easily adjusted in field or shop by turning slotted screw accessible through protective casing.



ETCHED CIRCUITS and dip-soldering assure positive electrical connections and permit easy replacement of components.



With G.E.'s 720-cycle off-peak control system, you reduce peak loads by automatically turning electric water heaters off during peak periods, releasing the extra capacity. The system (diagrammed) consists of station control equipment and individual load switches installed at water heaters.

You receive these off-peak control benefits and . . .

Solve Your Peak Load Problems with G-E

You can solve growing peak load problems with off-peak control of the electric water heaters on your system. By cutting the heaters off during the peak period, you reduce the demand load and gain these benefits:

RELEASED SYSTEM CAPACITY

If you multiply the number of electric water heaters on your system by 0.6 (the average KW demand per heater), the result is the capacity which can be released into your system by off-peak control.

LOWER INVESTMENT COSTS

Installed new capacity, per 0.6 KW, costs approximately $300. Off-peak control eliminates the need for new capacity and costs you only $25–$50 per heater.

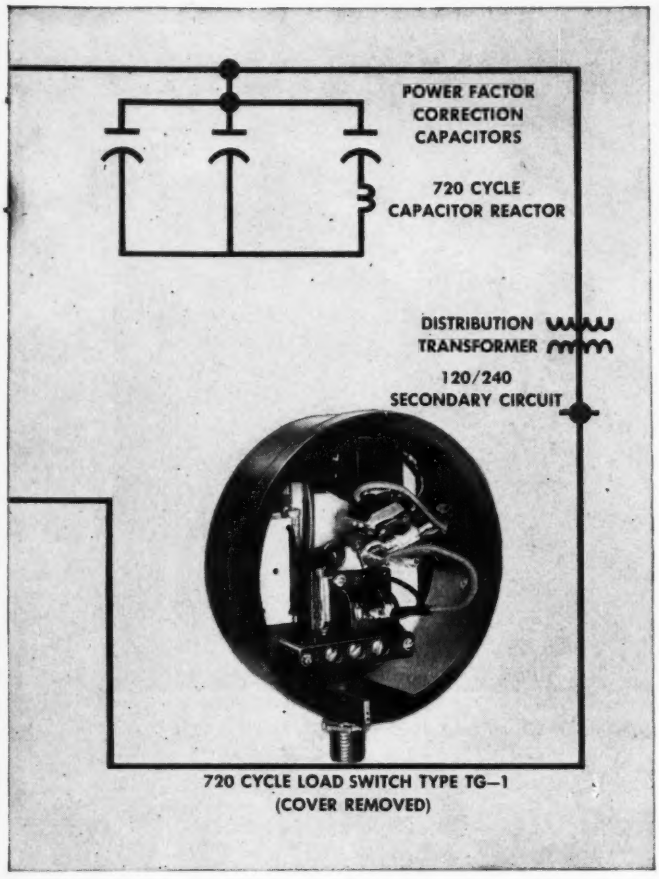
INCREASED SYSTEM LOAD FACTOR

If a substation serves 10,000 water heaters with an average load of 50,000 KW and a peak load of 90,000 KW (without control), the load factor—ratio of average load to peak load—is 56%. If the heaters are controlled the peak load is reduced by $10{,}000 \times 0.6$ per heater, or 6000 KW. Demand is lowered to 84,000 KW. Load factor is 60%—a 7.1% improvement in system efficiency.

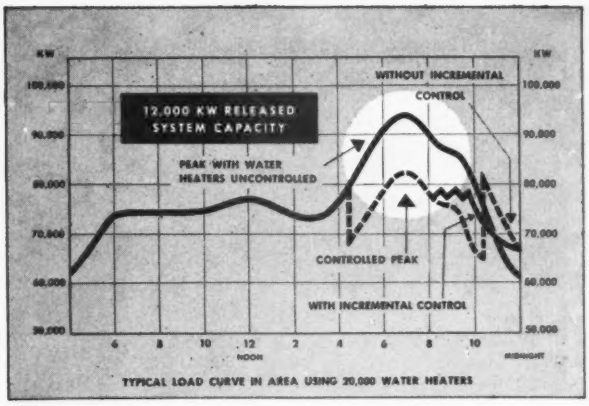
720-CYCLE OFF-PEAK CONTROL

A 720-cycle off-peak control system will help you realize these benefits. The system consists of centrally located

GENERAL ELECTRIC

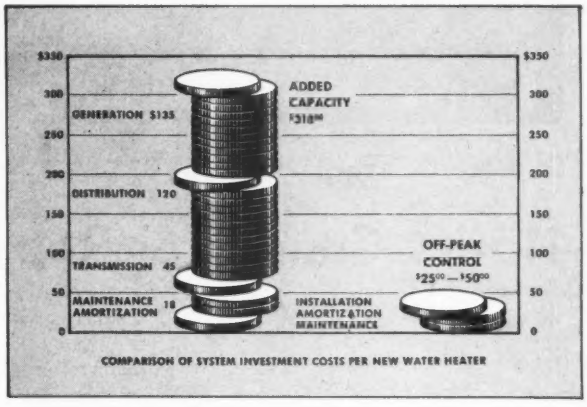


720 CYCLE LOAD SWITCH TYPE TG—1
(COVER REMOVED)



TYPICAL LOAD CURVE IN AREA USING 20,000 WATER HEATERS

RELEASED SYSTEM CAPACITY. A 720-cycle system will release enough extra capacity to considerably reduce peak loads. A new incremental feature now reconnects the heaters without causing secondary peaks.



COMPARISON OF SYSTEM INVESTMENT COSTS PER NEW WATER HEATER

LOWER INVESTMENT COSTS. Where pronounced peak loads occur it is unnecessary to install new capacity (costs approximately $300 per 0.6 KW). Off-peak control costs only $25–$50 per heater.

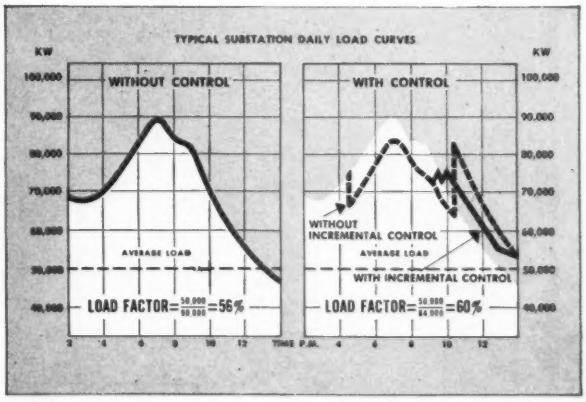
720-cycle Control

station control equipment and individual load switches installed at the water heaters. During the peak period, the switches automatically disconnect the heaters from the system. After the peak has passed, they automatically reconnect the heaters to the system.

NEW INCREMENTAL FEATURE

When the water heaters are reconnected to the system, the thermostats will usually call for more heat. On a system with a high water-heater saturation, this may frequently cause a secondary peak load. The automatic 720-cycle control includes a new incremental pickup feature which eliminates this problem. The new feature reconnects the heaters to the system in groups without causing any secondary peaks.

FOR MORE INFORMATION. Call your G-E Apparatus Sales Office, where a representative will be glad to discuss off-peak control in terms of your system. Or write for Bulletin GEA-5819 and GEC-931 to General Electric Company, Schenectady 5, New York. 603-62



INCREASED SYSTEM LOAD FACTOR. With 720-cycle off-peak control more KW hours can be sold without exceeding a given peak demand; the return on system investment is greatly increased.

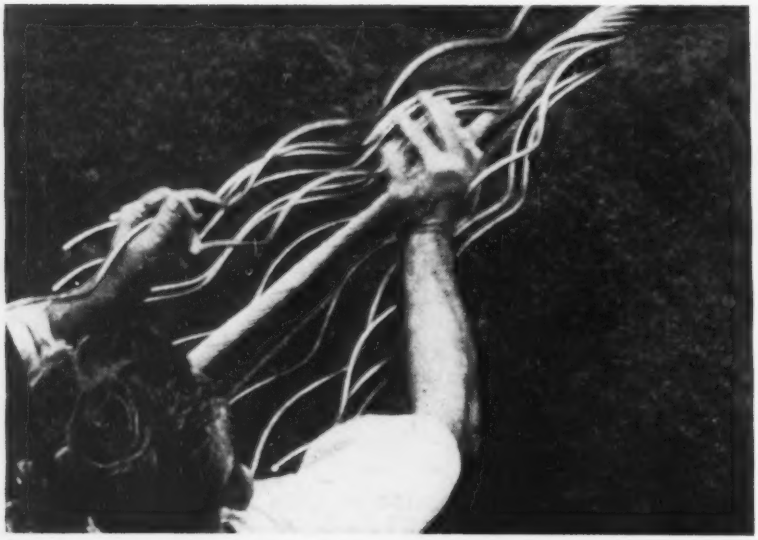
The Times-Picayune—New Orleans States

REPAIRING CONDUCTOR 450 ft up was done by two men in bosun's chairs who wrapped preformed armor rods around the 115-kv conductor

115-Kv Conductor Repaired in 14 Min

W. L. RUSH, Transmission and Distribution Engineer, Louisiana Power & Light Co, New Orleans, La.

A damaged conductor on a 115-kv river crossing line was recently repaired in 14 min by use of preformed splice rods. Cost of two sets of the rods was $17, but only one set was needed for the job. Replacement of the 3,950-ft conductor span would have cost about $1,500 (not including labor) and necessitated an outage of at least 24 hr. By use of this ingenious repair method, the line was only "out" 2½ hours.



WRAPPING STRANDS of heavy pretwisted aluminum around damaged conductor. Entire job, including hauling equipment up and down tower and rigging chairs, took less than 2 hr

The damaged conductor was on a 2-circuit, 115-kv line which crosses the Mississippi River at Harahan, ½ mile west of the Huey P. Long Bridge at New Orleans. It feeds out of the company's Nine Mile Point Steam Station. About 80% of its load (80,000 kw) serves the Chalmette plant of Kaiser Aluminum Co.

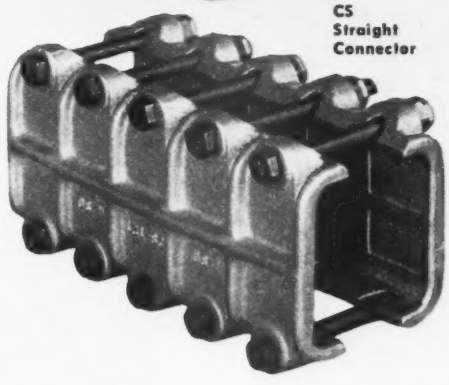
The 1.412-in. diam, 421,000-cir mils ACSR conductor (one of the bottom phases of the double circuit) was damaged during a flash storm by contact with a 300-ft length of ½-in. steel lashing wire used by a painting crew for anchoring bosun's chairs. Burned area of the conductor (about size of a half dollar) was located 15 ft from the suspension insulator. Five of the 21 aluminum strands of the outer layer were burned completely in two and five of the 37 steel strands were

(*Continued on page* 160)

DELTA-STAR builds a *Complete Line* of POWER CONNECTORS

FT
Clamp Type
Connector

TU
High Compression
Connector



CS
Straight
Connector

Whatever your requirements there is a Delta-Star connector designed specifically to do the job. Never is there any necessity of adapting a connector to your particular application. There is available at Delta-Star the exact connector you require in clamp or solder types for copper or aluminum conductors with all the characteristics that have won such general acceptance throughout the industry.

Delta-Star clamp type connectors incorporate all three essential requirements of positive electrical and mechanical connection, ease of installation, and continuity of service over long periods of time.

Positive electrical and mechanical connection— all Delta-Star connectors are cast-to-size in our own foundry and surface strength is left intact by the elimination of machining. Strong gripping action is secured by the retention of a great number of minute projections which dig into the tube or cable as bolts are tightened and help prevent slippage or loosening.

Ease of installation — high compression clamp type connectors are designed as a one-piece unit with U-bolts held securely in position by bent-over yoke projections. Other types are designed whenever possible with two halves of like dimensions. Being interchangeable no care need be taken to keep them in pairs.

Long continuity of service — Delta-Star connectors are cast from an alloy stronger than copper under rigid foundry control. U-bolts and nuts are of DURONZE, a non-ferrous bolt material with a splendid service record. Edges and ends are rounded to eliminate crystallization or adhesion. No detail, however small, which adds to dependability has been overlooked or neglected.

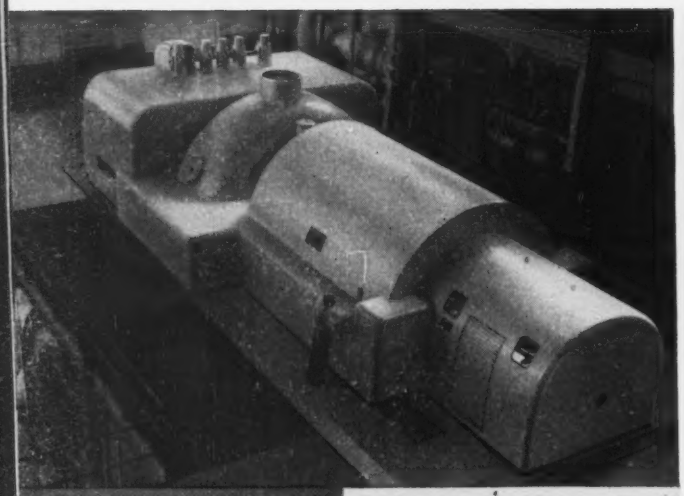
NEW CATALOG now being prepared covers the complete line of Delta-Star Power Connectors: contains Technical Data Section with Tables and Charts pertaining to application of various types. Reserve your copy.

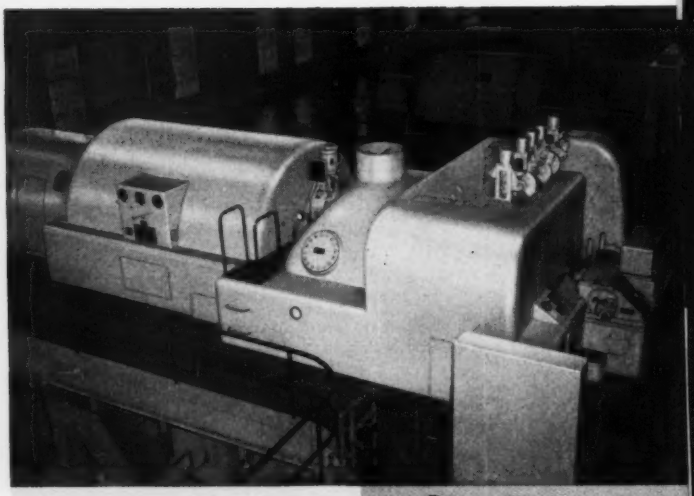
DELTA-STAR ELECTRIC DIVISION

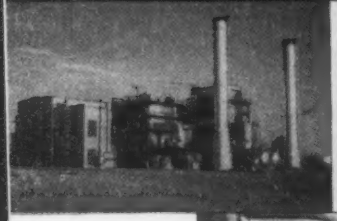
H. K. PORTER COMPANY, INC.
OF PITTSBURGH
2437 FULTON STREET, CHICAGO 12, ILLINOIS
DISTRICT OFFICES IN PRINCIPAL CITIES

WHEN YOU WANT THE BEST IN HIGH VOLTAGE EQUIPMENT SPECIFY DELTA-STAR

Expanding

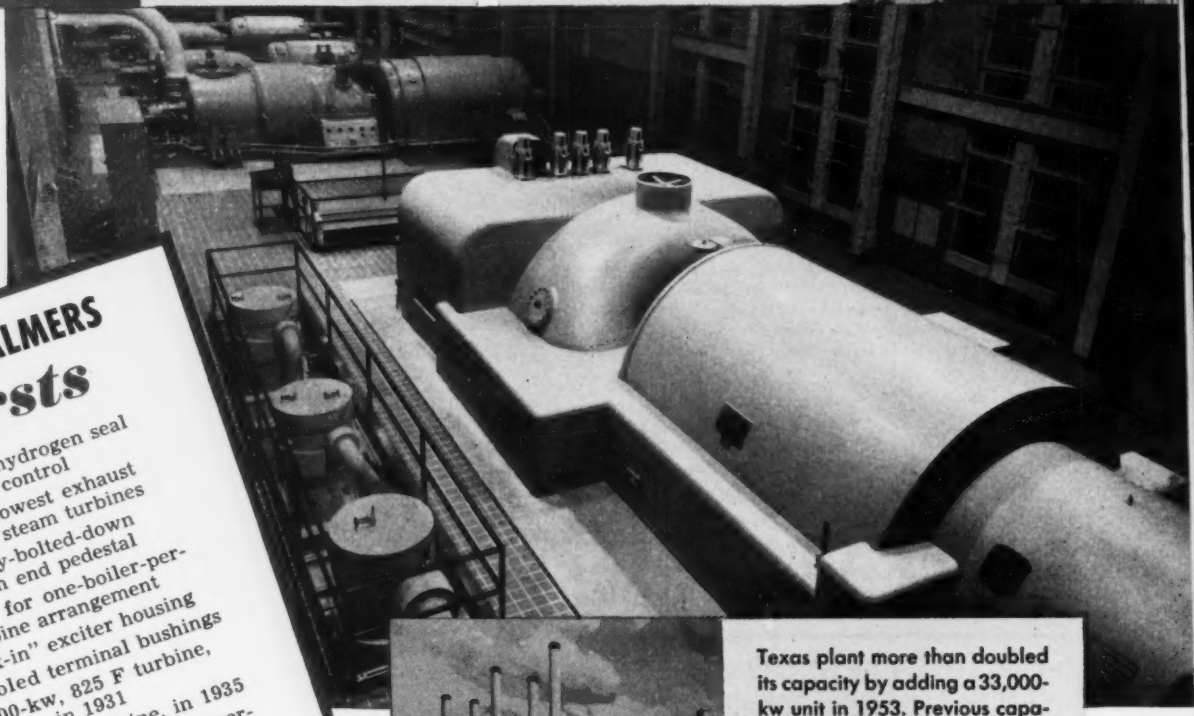






California's Imperial Valley is the setting for this 33,000-kw turbine-generator installation. Allis-Chalmers also supplied the condenser shown in this semi-outdoor power plant.

Upper Midwest area is represented by 22,000-kw turbine-generator unit placed in operation in 1952. Two 10,000-kw units in background were also supplied by A-C.



ALLIS-CHALMERS ★Firsts

Simplified hydrogen seal and control

World's lowest exhaust pressure steam turbines

Solidly-bolted-down steam end pedestal

Turbine for one-boiler-per-turbine arrangement

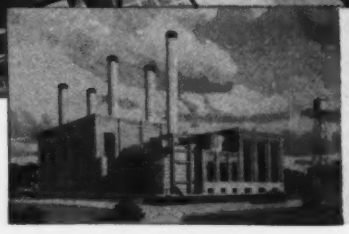
"Walk-in" exciter housing

Jet-cooled terminal bushings

30,000-kw, 825 F turbine, in 1931

825 F reheat turbine, in 1935

And NOW ...First with super-charged hydrogen cooling



Texas plant more than doubled its capacity by adding a 33,000-kw unit in 1953. Previous capacity consisted of one 15,000-kw and two 5000-kw units — all supplied by Allis-Chalmers.

POWER
...Coast to Coast!

Dependable Allis-Chalmers Turbine-Generator Units Keep Pace with Growing Nation-Wide Power Demand

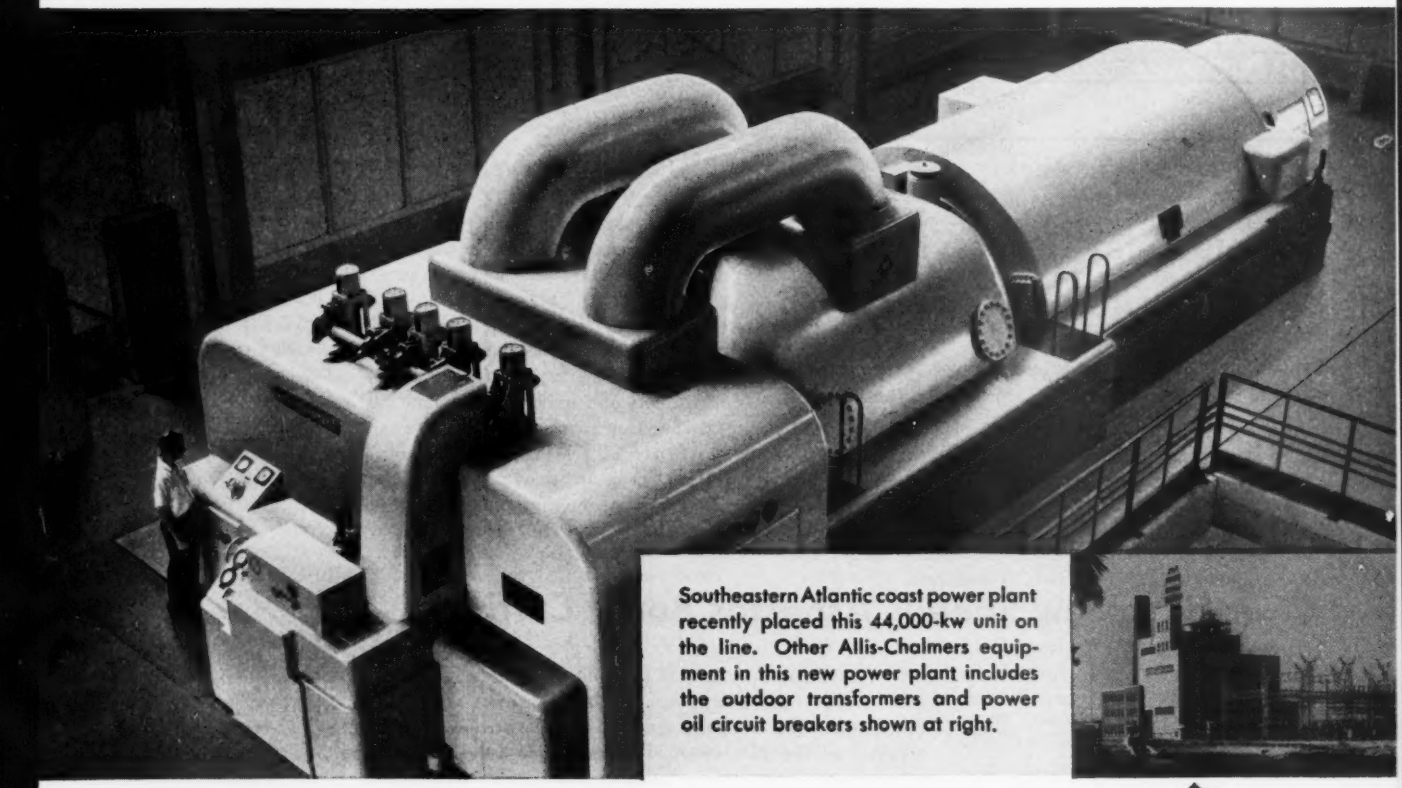
FROM coast to coast and border to border, the nation's demand for power continues to soar. Pictured here are a few of the newly installed Allis-Chalmers steam turbine-generator units now helping to satisfy that country-wide mounting demand for electric power.

Each of these modern 3600-rpm units conforms to AIEE-ASME preferred standards, and all of them include important A-C design features.

The generators offer simplified hydrogen seals and control, spiral stator ventilation, flexible core mounting, and "walk-in" exciter housings.

Outstanding turbine features include accessible placement of hydraulically operated stop valve, centralized grouping of operating controls, conveniently located cam-operated inlet valves, and an effective method of compensation for horizontal and vertical thermal movement. Above-the-floor oil piping simplifies foundation and installation. The steam-sealed gland system, feeding labyrinth-type glands, is self-contained and automatic, for dependability with minimum attention.

These and other advanced turbine and generator design features are also incorporated in 60,000-kw to 150,000-kw reheat units now in operation or nearing completion. For more information, contact your A-C representative, or write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-4187



Southeastern Atlantic coast power plant recently placed this 44,000-kw unit on the line. Other Allis-Chalmers equipment in this new power plant includes the outdoor transformers and power oil circuit breakers shown at right.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

14-Minute Repair

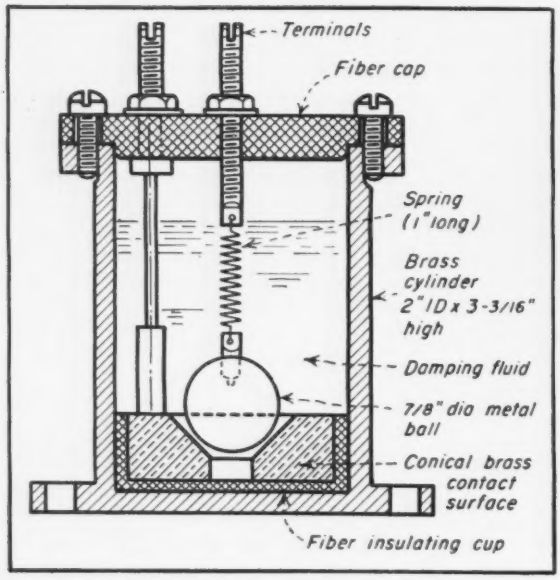
(*Continued from page* 156)

burned severely. An estimated 10,000 lb from the 75,000-lb original conductor strength was lost. Tension in span is estimated at about 20,000 lb.

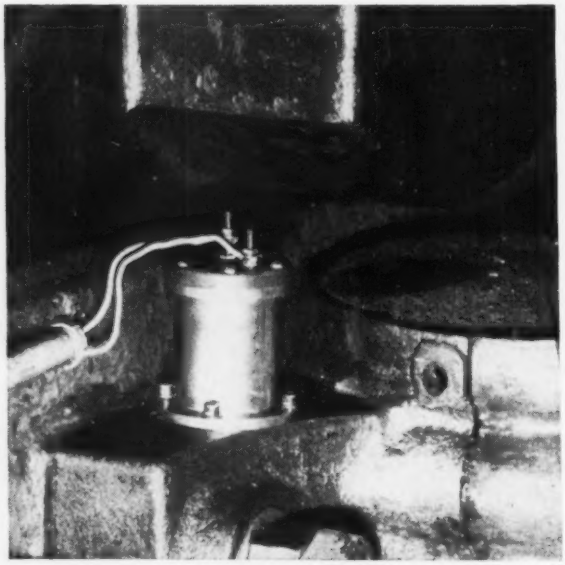
At first, it was anticipated that the entire 3,950-ft length of conductor would have to be replaced. This would have been expensive, not only in cost of labor and material, but in a 24-hr outage of the line ($7,680 revenue at 4 mill rate). However, 2 sets of the preformed splice rods, made to special tolerances were delivered within a week. The rods make a protective wire sheathing that grips tightly over the conductor forming another protective cable all its own.

After spending about 10 min scraping the damaged area of the conductor clean and applying abrasive-anti-oxident compound, two men in bosun's chairs installed the 10½-ft long aluminum preformed repair cover. They used no tools—only their bare or gloved hands. One after another, the strands popped easily into place and in 14 minutes the wrapping was complete. The job, including hauling equipment up and down the tower and rigging chairs, took less than two hours.

The manufacturer supplying the rods guaranteed that the new protective wire sheathing would more than restore the loss of strength and conductance of the damaged conductor to valves in excess of requirements.



SPRING-SUSPENDED BALL makes contact with brass cup



VIBRATION RELAY is set on water wheel bearing

Simple Relay Detects Excessive Vibration in Bull Wheel

T. W. DUGDALE, Division Supervisor of System Operation, Indiana & Michigan Electric Co, South Bend, Ind.

A simple relay detects excessive vibration caused by loosened wooden cogs in bull wheels at an Indiana & Michigan Electric Co hydroelectric station, which was converted to semi-automatic operation. Relay will trip the unit immediately, thus avoiding serious damage.

The relay can be adjusted to tolerate normal bearing vibration. If either vertical or horizontal vibration becomes excessive, the suspended ball contacts conical insert and completes the trip circuit. A light alarm attracts dispatchers and indicates unit that has loose cogs.

Refined inexpensive models of this relay were made for all horizontal bearings in the plant. Semi-automatic operation for more than six months has proved that these relays perform their intended function and are trouble free.

Over-Hung Saw Speeds Asbestos Board Cutting

W. B. SULLIVAN, General Foreman, Shops & Special Services Division, Potomac Electric Power Co, Washington, D. C.

Cutting asbestos board with a high-speed, overhung sawing machine has solved a difficult operation in the General Shops of Potomac Electric Power Co. The machine cuts ⅜-in. material at the rate of 12 fpm and the cut edges requires no finishing.

Sheet asbestos board of several thicknesses is used extensively by the company for flash barriers, cell door panels, and to construct cells for switching equipment. The machine, designed by the author and constructed in the company's General Shops, consists of an abrasive disk rotating at

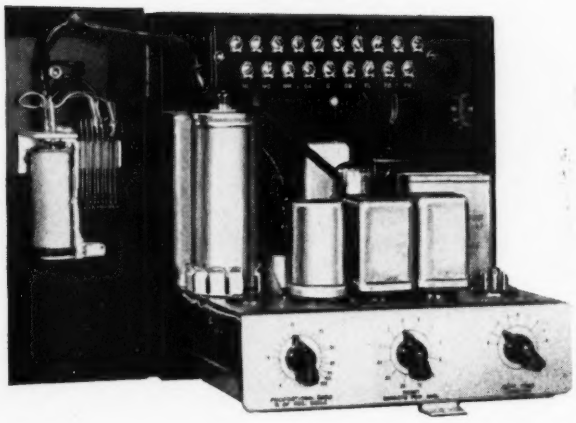
(*Continued on page* 164)

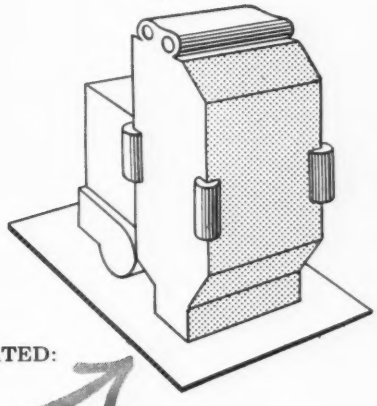
CONTROL ACTIONS:

- *Proportional Action*
- *Reset Action*
- *Rate Action*
- *Anticipatory Action from changes in combustion rate*

CONTROLLING QUANTITY OR FUNCTIONS:

- *Superheat Temperature*
- *Reheat Temperature*
- *Sum or Difference of Superheat and Reheat Temperature*





EQUIPMENT ACTUATED:

- *Desuperheating valves*
- *By-pass dampers*
- *Tilting burners*
- *Gas recirculation dampers*
- *Proportioning dampers*
- *Condenser valves*

THIS ELECTRONIC CONTROLLER HAS THE

flexibility

TO HANDLE YOUR SUPERHEAT-REHEAT CONTROL PROBLEMS

Here is a controller which looks at superheat temperature, reheat temperature or any of their combinations—electronically "computes" the proper control action—and applies it to the correct actuator or group of actuators.

This flexibility of control is vitally important in regulating today's critical superheat-reheat temperatures. Your boiler may employ dampers, tilting burners or valves, separately or in combinations, each having its individual control characteristics. In many steam generators a single actuator affects both superheat and reheat temperatures over part of the load range. As load and furnace conditions require the control to regulate different actuators or groups of actuators, the *control actions* as well as the *controlling quantity or function*—superheat, reheat, or the sum or difference of these temperatures—must be varied accordingly.

The built-in electronic intelligence of the L&N Series '50 Controller enables it to consider all these variables simultaneously. This controller has been supplied with as many as four separate groups of *control actions*—proportional, reset, rate and anticipatory—to meet individual control needs.

Inherent self-balancing permits rapid automatic transfer from one actuator to another, while introducing a completely new set of control actions, as well as a different control quantity or function.

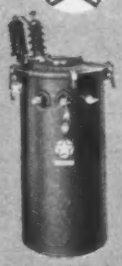
Inherent flexibility of the Series '50 Controller allows the complete superheat-reheat control system to guard against interaction of the two steam temperature controls and to provide the close temperature regulation your boiler requires.

If you're thinking of tomorrow's—as well as today's—superheat-reheat control problems, why not look to L&N—the only instrument company offering integrated controls for *both* steam and electrical generation. Write Leeds & Northrup Co., 4938 Stenton Avenue, Philadelphia 44, Pa.

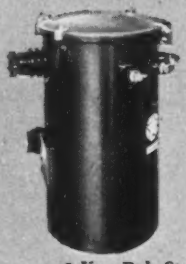
LEEDS NORTHRUP
instruments *automatic controls • furnaces*

POLE STAR DISTRIBUTION TRANSFORMERS

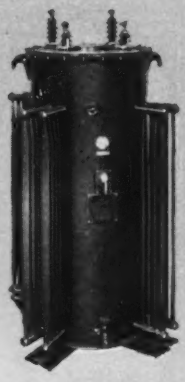
Pole Star Distribution Transformers — 3 Kva through 500 Kva, 2400 through 67,000 volts



Protected Pole Star (CSP® Transformers) 3 Kva through 100 Kva 2400 through 14,400 volts



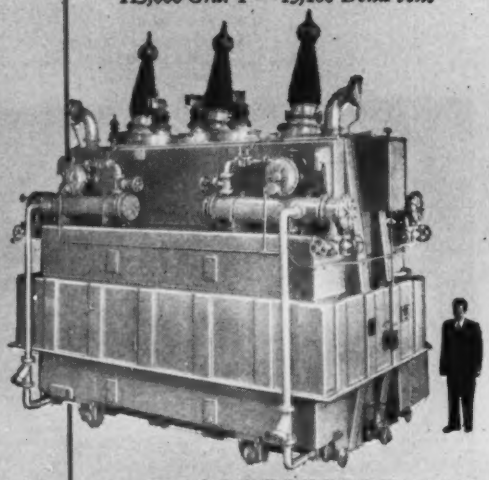
5 Kva Pole Star 2400/4160Y — 120/240 volts



500 Kva Pole Star 13,200 — 2400/4160Y volts

105,000 Kva, Three-phase

115,000 Grd. Y — 13,200 Delta volts

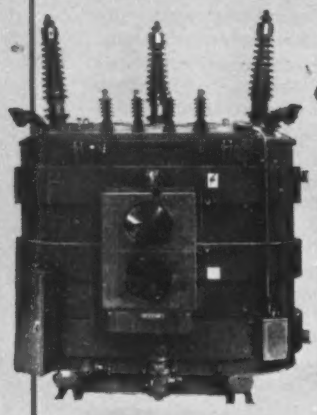


CONTOUR DESIGN

TRANSFORMERS...

PENNSYLVANIA TRANSFORMER COMPANY'S ONLY PRODUCT

CORE FORM POWER TRANSFORMERS



138,000 Volts

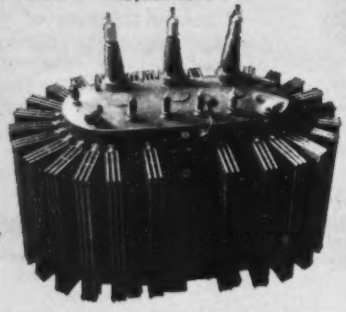
37,500 Kva, Three-phase 132,000 Grd. Y — 24,000Y/13,860 — 6900 Delta volts

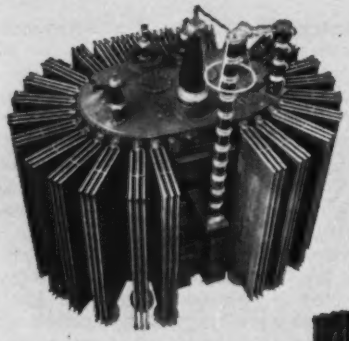
132,000 Volts

20,000 Kva, Three-phase, 132,000 Delta — 26,400Y/15,240 volts

161,000 Volts

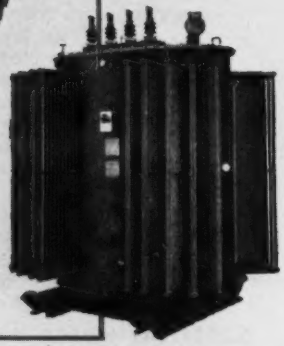
56,000/70,000 Kva, Single-phase. 93,000/161,000 Grd. Y — 19,000 volts

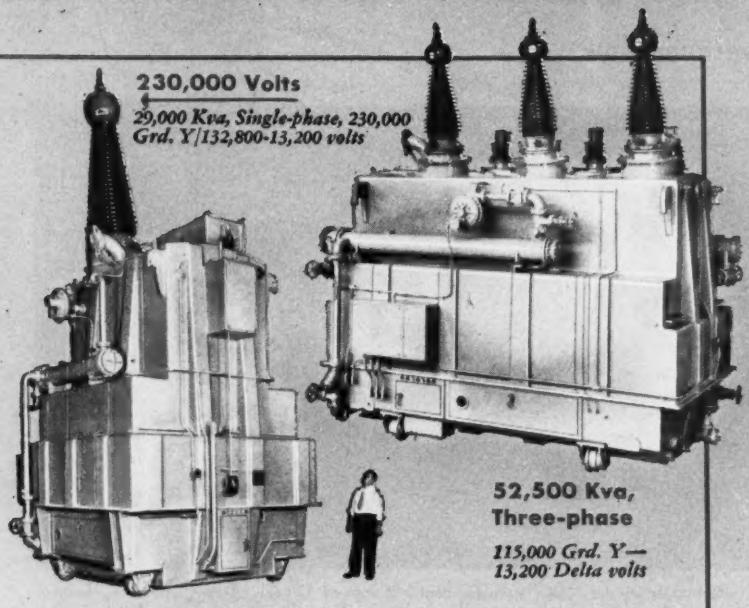




STANDARD PARTS POWER TRANSFORMERS

Three-phase: Up to 10,000 Kva, 34 Kv
Single-phase: Up to 5,000 Kva, 34 Kv





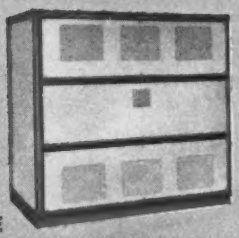
230,000 Volts

29,000 Kva, Single-phase, 230,000 Grd. Y/132,800-13,200 volts

52,500 Kva, Three-phase

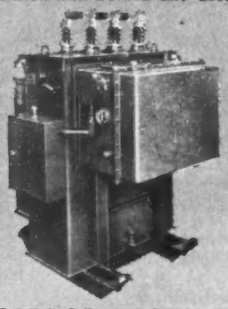
115,000 Grd. Y— 13,200 Delta volts

SHELL FORM POWER TRANSFORMERS



DRY TYPE

Sealed, Ventilated and Forced-Air-Cooled



STEP VOLTAGE REGULATORS

Up to 750 Kva for plus or minus 10% regulation in 32 steps

DISTRIBUTION TRANSFORMERS

3 Kva through 500 Kva
Up to 67,000 volts

POWER TRANSFORMERS

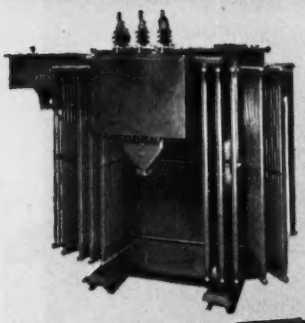
750 Kva to 250,000 Kva
Up to 330,000 volts

For 24 years, we have concentrated on designing and manufacturing one product — transformers. Each year we do more business than the previous year, and each year we keep bettering our product. We count among our customers the finest Utilities and Industrials in the country. We believe that if you are interested in transformers, you'll want to investigate Pennsylvania. We invite you to contact us.

PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division

CANONSBURG, PA. *Greater Pittsburgh District*

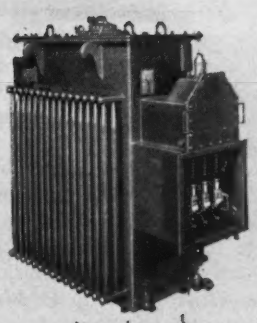


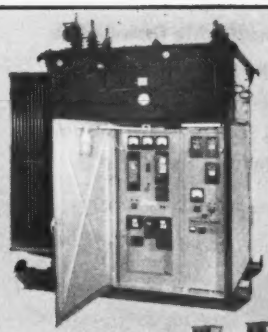
ASKAREL

Non-inflammable, liquid-filled Distribution and Power Sizes

NETWORK

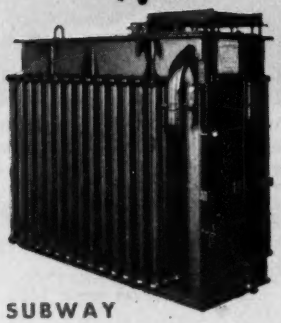
300 through 1,000 Kva. 2400 through 34,400 volts





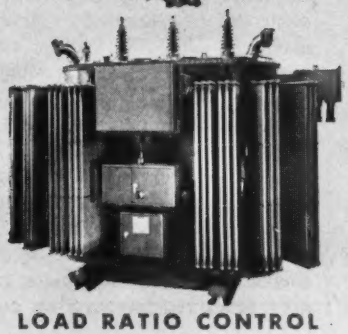
UNIT SUBSTATION

Single-Circuit and Duplex Unit Substations



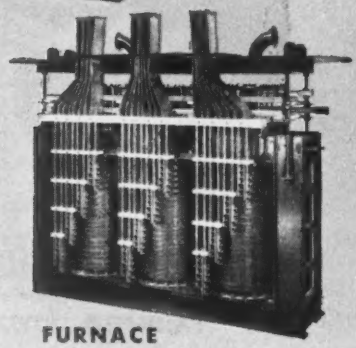
SUBWAY

Submersible Type, Single and Three-phase



LOAD RATIO CONTROL

For changing transformer taps under load in sizes up to 50,000 Kva



FURNACE

For operating Electric Arc Furnaces of any tonnage

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life

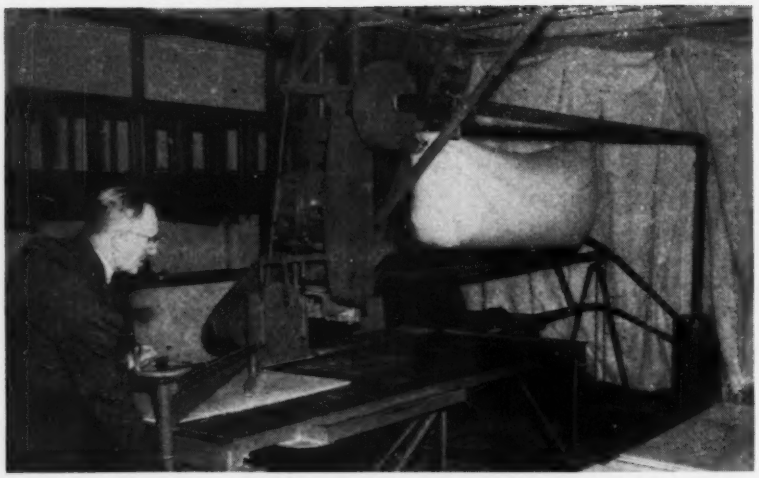
● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE
EVERSTICK
FEATURE
Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.
Manufacturer of "THE ANCHOR OF MERIT"
FAIRFIELD, IOWA

Overhung Saw

(*Continued from page* 160)



SAWING MACHINE cuts ⅜-in. asbestos board at rate of 12 fpm. After material is clamped in position, operation is automatic. Dust collector at right rear removes about 98% of dust

high speed, mounted on a conventional saw mandrel, all of which is rigidly suspended from the ceiling.

Material is clamped on the surface of a traveling table, which carries it under the saw. Operation is entirely automatic after material has been clamped in position, the saw started, and the clutch engaged to move the table. A dust collector is provided which removes approximately 98% of the dust.

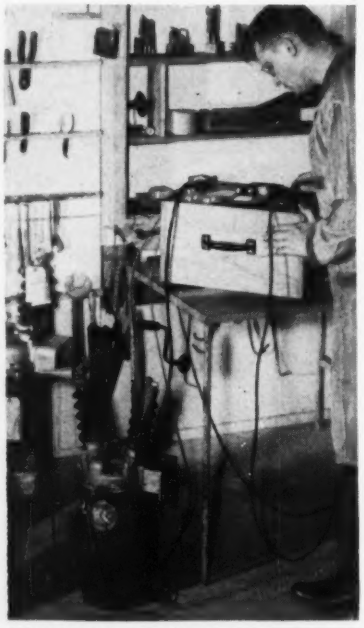
Dc Instrument Tests Recloser Insulation

R. W. **BETHKE**, Asst Design Engineer, Kyle Products, Line Material Co

A portable tester has been developed for high-voltage dc insulation testing to aid maintenance of oil circuit reclosers and distribution oil switches. It eliminates the possible destructive effects of overpotential ac testing and measures only the in-phase leakage current.

Operating from a 115-v, 60-cps source, the tester has two instruments that measure dc conductance and voltage impressed across the insulation. From these measurements, insulation resistance values up to 30,000 megohms can be computed. Curves for maximum allowable leakage current vs temperature facilitate equipment tests.

The ammeter measures current in two ranges—0 to 50 and 0 to 1,000 microamperes. It is protected against surges by a capacitor across its terminals and against overcurrents by a neon bulb that flashes and by-passes over-scale currents. Both meter ranges have series resistors to limit current to a safe value in case of insulation failure or accidental contact by operating personnel.



INSULATION TESTING is done with a dc tester that eliminates the possible destructive effect of overpotential ac testing

(*Continued on page* 169)

You Can't Do This To Insulators!

O-B Maintains Normal Service Records In One of World's Toughest Spots

Under this ice are strings of O-B suspension insulators operating at 150 kv. Location of this line crossing the Alps is so fantastically bad that men cannot patrol it in certain months -- let alone repair it! And, for ten years, it has shown an enviable operating record.

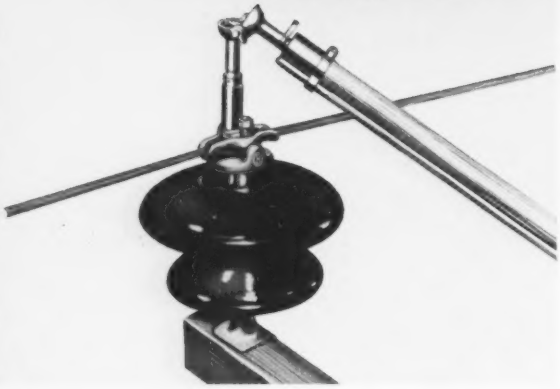
It takes a lot more than good insulators to produce such performance, but the insulators help. Here is an exacting combination of mechanical stresses; extremely heavy ice accompanied by high wind, as the ice formation clearly shows, and severe thermal loading to the insulator assembly brought about by unusually low temperatures. Yet the O-B suspension insulators with which this line is fully equipped, take all this in their stride.

Here is proof of what these insulators *can* do -- and *are doing*. It's proof of the peace of mind you will have when your lines are insulated by O-B.

Ohio Brass

MANSFIELD, OHIO, U.S.A.

HI-TENSION NEWS *Junior*



Clamptops handle with hot line tools in, possibly, as little as half the time of a conventional tied insulator, providing—(see next picture)

—providing the clamp is free to slide along the conductor for re-positioning at the new insulator location. This feature is inherent in the O-B design.

You don't have to "tinker" with O-B Clamptops

Have you ever thought much about the *second time* you may work on your insulators? Pole, crossarm, conductor, or insulator damage may call for a "hot" change-out. The basis of most hot line work is disconnecting and reconnecting the conductor and insulator. How well does a given insulator handle?

Simplest of all insulators to work hot, and safest, is the Clamptop. Lacking just one feature, however, all this simplicity would disappear. The clamping piece must be free to slip on the conductor to "re-register" with the new position of the insulator top—and this position always changes, at least slightly.

With the O-B Clamptop, the act of disconnecting it from its insulator automatically loosens its hold on the conductor. The clamp is free to re-position. Later, one tightening operation completes attachment to the insulator and grips the conductor simultaneously.

Only a hot-line workman might think about this detail that can make or break a clamping type insulator design but, to him, easy re-positioning of the clamp is the difference between a simple job and endless tinkering with his hot stick—tinkering that costs real money, at best, and that may be a near-impossible job.

When you buy Clamptop insulators, pintypes or posts, remember that O-B has been through years of pioneer development and experience with this design. For a practical, workable, and adequately tried-out Clamptop, specify O-B.

How Big Is A 1-Inch Cotter Pin?

Hardware Replacement Components Are Now Described and Listed In O-B's New Number 28 Catalog

Let's assume a plain brass cotter pin that has an over-all length of 1⅜ inch and, when squeezed tightly shut, has a diameter of 5/32 inch. This is a common item in many pieces of line hardware. But, ignoring the loop, the shank portion measures only 1 inch and, since the two legs are always slightly spread, it measures 3/16 inch across the end.

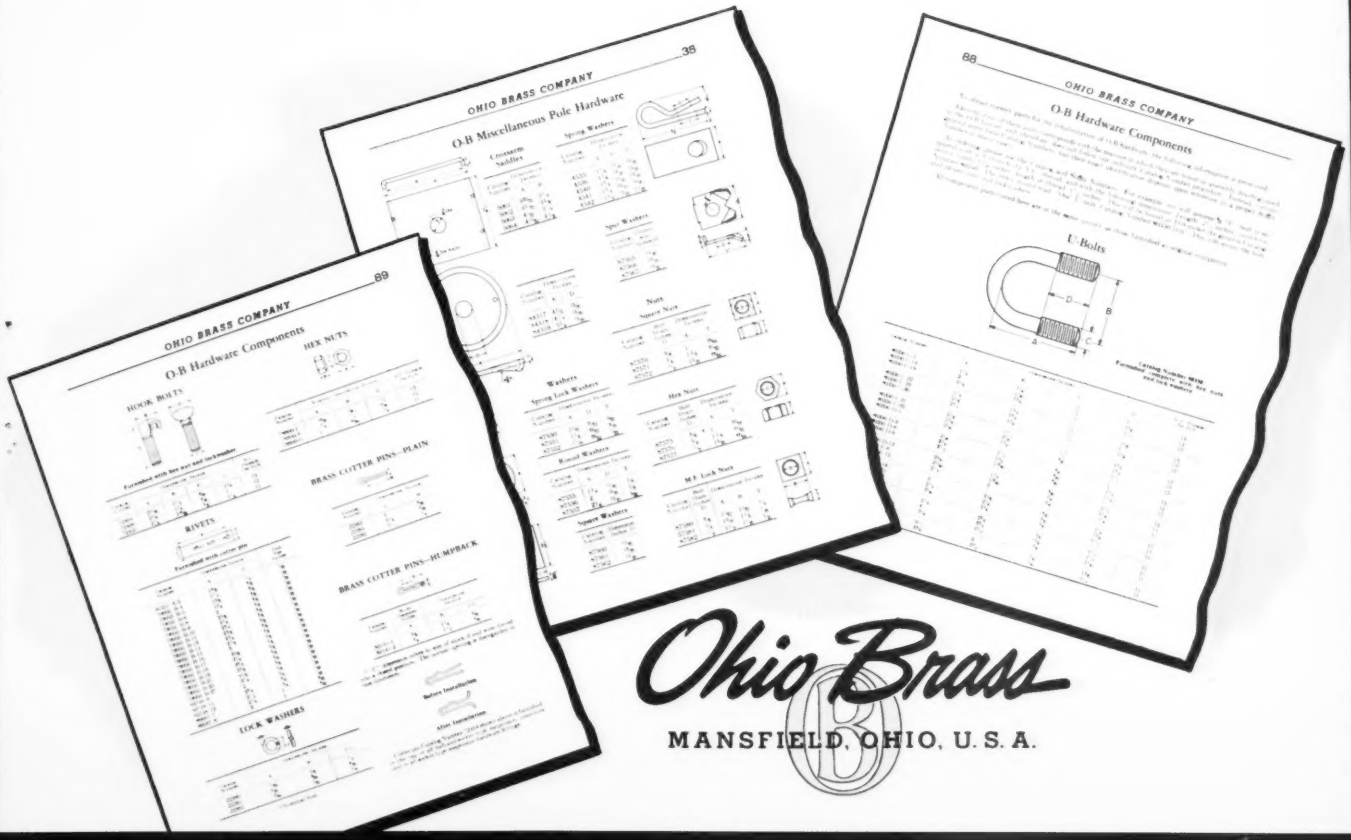
You want some of these cotter pins for replacement. What do you say on the order?

For years we have been trying to get along with this problem. Sometimes, postage and telephone calls amounted to nearly as much as the material, by the time the customer and ourselves thoroughly understood each other. In other cases, the buyer in desperation simply fastened an old piece to his purchase order and said " . . . a thousand like this."

Now you can turn to a page in the new O-B Insulator Catalog and see descriptive drawings with catalog listings covering the full range of U-bolts, hook bolts, nuts, rivets, washers, cotter pins, and all the other items required for the rehabilitation of line hardware and crossarm pins. You will be supplied with material properly adapted to the job and equal in quality to the original parts. There will be no confusion in describing your exact requirement.

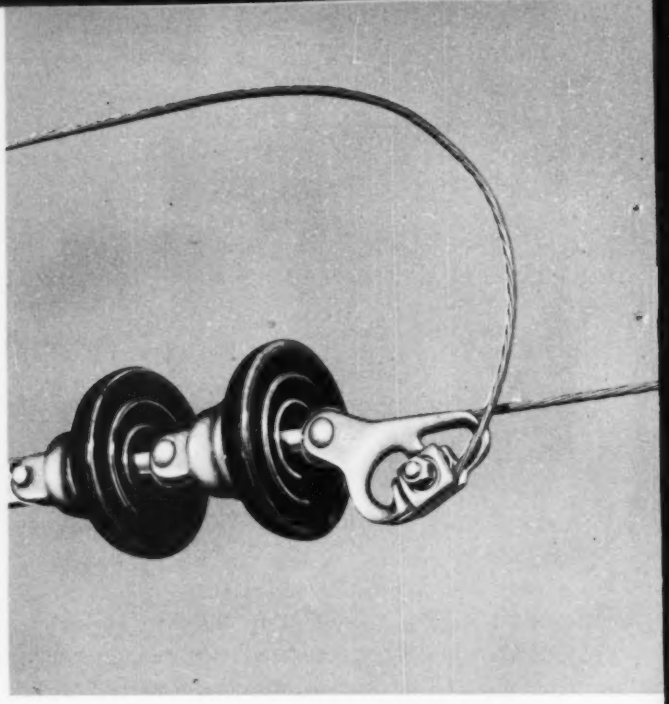
We don't anticipate getting rich on this business, but we believe it will save a lot of gray hairs in Purchasing Departments, and it is indicative of O-B's effort to do an intelligent job of cataloging material.

. . . And by the way, have you seen the new Number 28 O-B Insulator Catalog?



Ohio Brass

MANSFIELD, OHIO, U. S. A.



Save a lot of trouble –at no extra cost

Buy these O-B Distribution Materials from your local Graybar warehouse

You can buy these and other distribution line materials direct from O-B, but there's an easier way.

At established l.c.l. prices, Graybar Electric Company will deliver O-B materials right to your receiving dock or collection point. You haven't had to carry them in inventory or maintain paper work to keep up stocks. A lot of hidden costs can be saved, and there's no premium on the selling price.

Graybar will gladly work with you to establish adequate local supplies of desired O-B items, and the pooling of these with other nearby power company requirements assures a comfortable "cushion" to meet emergency demands—more than you could wisely afford to set up single-handed.

It costs no more dollars, and a whole lot less trouble, to buy your O-B distribution materials locally—through Graybar.

Distributed by GraybaR ELECTRIC COMPANY

Ohio Brass

MANSFIELD, OHIO, U. S. A.

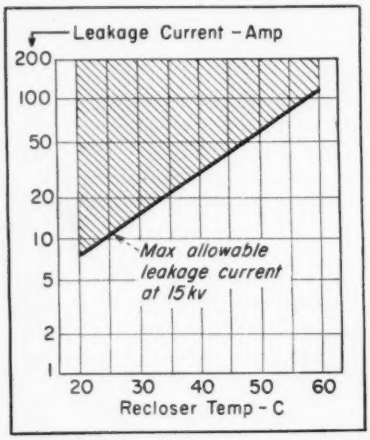
4406-H

Testing Insulation

(*Continued from page* 164)

A bleeder resistor voltmeter measures the output voltage, 1 to 15 kv, that is controlled by a variac in the ac supply. An adjustable gap that discharges the output capacitor protects high-voltage components from accidental overvoltages.

Recent studies have shown that overpotential 60-cps withstand testing has a fatiguing effect on insulation. The higher the test voltage is above operating voltage, the greater the



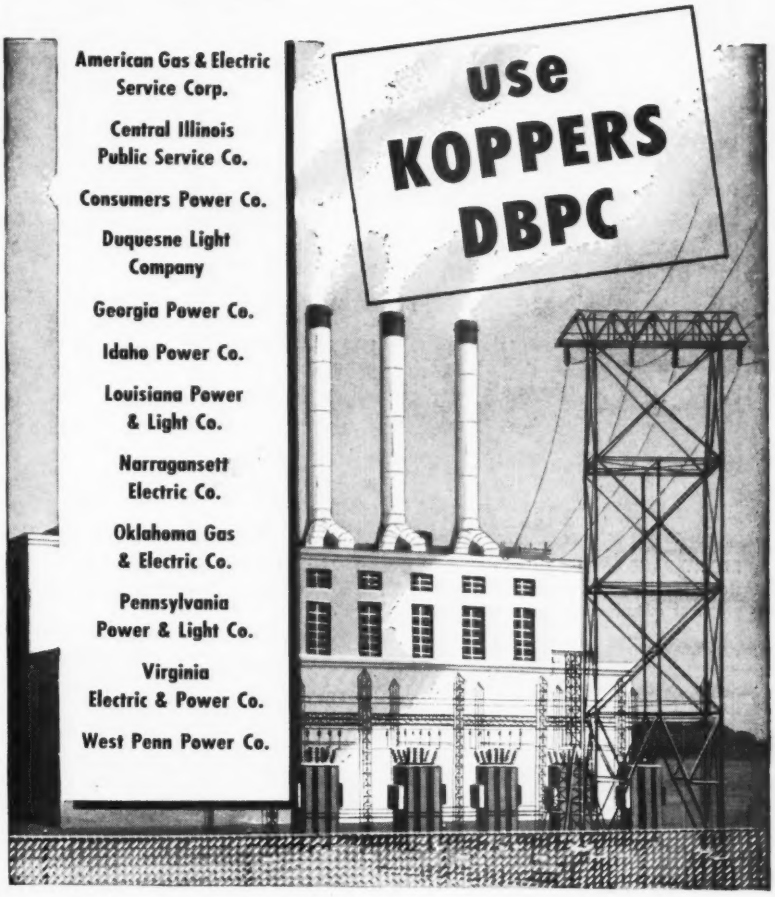
LEAKAGE CURRENT values falling in the shaded area indicate that the insulation needs to be dried out or replaced.

fatiguing effect. High-voltage dc testing, on the other hand, does not produce the fatiguing effect until near breakdown. Because breakdown can be foretold by a sharp increase in leakage current, normal caution will prevent insulation fatigue or failure.

During ac tests, current passing through insulation consists of a small in-phase leakage current and a large out-of-phase capacitive current. Unless additional equipment is used to distinguish and measure leakage current, it is masked by capacitive current. Sudden unexpected insulation failure can result. Because ac test equipment must supply both componets of current, test apparatus is bulky and expensive.

The high-voltage dc tester supplies and measures only the leakage current through the insulation and, therefore, requires less expensive and small apparatus. Spacing or shielding of leads is unnecessary because stray capacitances to adjacent metal structures or ground do not affect dc readings.

Increase transformer oil life like these companies do . . .


American Gas & Electric Service Corp.
Central Illinois Public Service Co.
Consumers Power Co.
Duquesne Light Company
Georgia Power Co.
Idaho Power Co.
Louisiana Power & Light Co.
Narragansett Electric Co.
Oklahoma Gas & Electric Co.
Pennsylvania Power & Light Co.
Virginia Electric & Power Co.
West Penn Power Co.
use KOPPERS DBPC

HIGH-LOAD TRANSFORMERS require a sludge-free insulating oil. Di-tert-butyl-para-cresol greatly increases the resistance of transformer insulating oils to oxidation and keeps sludge formation to a minimum. It assures longer oil life and more efficient transformer performance.

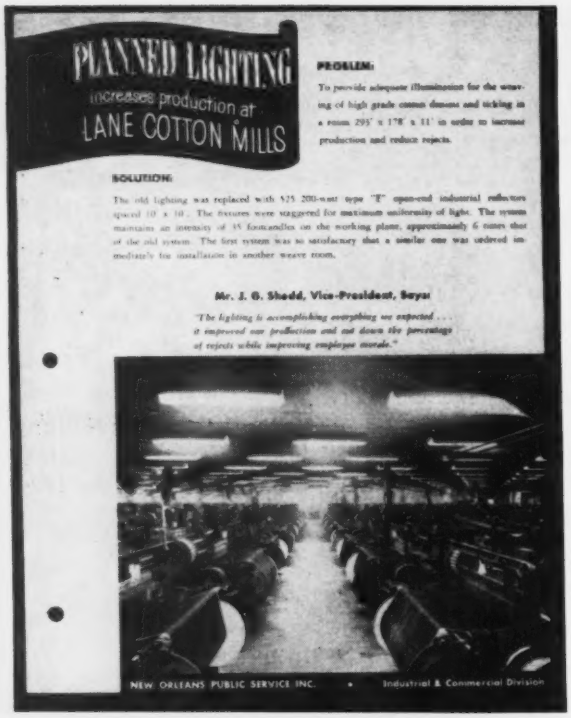
Accelerated oxidation tests have proved that new transformer oil treated with 0.3% of DBPC will last *14 times longer* than untreated oil. Reclaimed oil will last longer, too, when treated with DBPC. Although badly deteriorated and heavily sludged, used oil can be restored by treatment with fuller's earth and DBPC so that it will actually outlast brand new uninhibited oil!

DBPC is also available in an oil solution called IMPRUVOL 20. Either of these inhibitors can be used in transformers and circuit breakers. Write us for additional information.

KOPPERS®

Koppers Chemicals

KOPPERS COMPANY, INC.
Chemical Division, Dept. EW-12143
Pittsburgh 19, Pennsylvania



PLANNED LIGHTING increases production at LANE COTTON MILLS

PROBLEM:

To provide adequate illumination for the weaving of high grade cotton damask and ticking in a room 295' x 178' x 11' in order to increase production and reduce rejects.

SOLUTION:

The old lighting was replaced with 525 200-watt type "E" open-end industrial reflectors spaced 10' x 10'. The fixtures were staggered for maximum uniformity of light. The system maintains an intensity of 35 footcandles on the working plane, approximately 6 times that of the old system. The first system was so satisfactory that a similar one was ordered immediately for installation in another weave room.

Mr. J. G. Shedd, Vice-President, Says:

"The lighting is accomplishing everything we expected . . . it improved our production and cut down the percentage of rejects while improving employee morale."

NEW ORLEANS PUBLIC SERVICE INC. • Industrial & Commercial Division

FRONT PAGE of data sheet on local industrial plant relighting job states problem, solution, customer's statement of reaction, and photograph of installation

PLANNED INDUSTRIAL LIGHTING WILL

Increase production
Decrease spoilage and rejects
Produce a greater uniformity of quality
Decrease accidents
Lower maintenance costs
Improve employee morale
Promote good housekeeping

HOW MUCH LIGHT DO YOU NEED?

Maximum benefits from Industrial Planned Lighting depend upon having the proper quantity and quality of glare-free illumination, so as to permit maximum utilization of men, machines and space.

The following shows good current practice for Industrial Lighting as recommended by the Illuminating Engineering Society:

AREA	*RECOMMENDED FOOTCANDLES*
Fine bench and machine work	100 (75 - 200)
Medium work	50 (40 - 75)
Rough work	30 (20 - 50)

WHAT ABOUT COLOR?

To get the best results from Planned Industrial Lighting, the following should be used:

Ceiling	Flat white (75-85% reflectance)
Walls	Flat light color (50% reflectance)
Floor	Light color (40% reflectance)
Machinery (work area)	Light color (50-60% reflectance)

PLANNED MAINTENANCE

Regular washing of lamps and fixtures and prompt replacement of burned out lamps are essential for good lighting. Light output may decrease as much as 50% if fixtures are not properly maintained.

BACK PAGE of same data sheet gives advantages of Planned Lighting, recommends intensities and colors, and gives advantages of proper and regular maintenance

Data Sheets Sell Home Town Lighting

JOHN D. HAVERKAMP, Commercial Supervisor, New Orleans Public Service, Inc

The value of using local lighting data sheets has been proven many times in the experience of our company. Local people indicate that they are much more interested in knowing what other people in their own home town are doing—rather than what people are doing in some other town.

Photographs . . . One of the most powerful aids in the sale of Planned Lighting always has been the use of photographs of other Planned Lighting jobs. Fixture and lamp manufacturers, as well as the Illuminating Engineering Society, have cooperated with the utilities and the lighting dealers with a steady supply of such photographs for many years.

Such photographs, either by themselves or incorporated with other information in the form of lighting data sheets, have been very helpful in selling Planned Lighting. However, necessarily, they are on a national basis and essentially show what people are doing in other towns.

Local Data Sheets . . . These local lighting data sheets are not designed to replace the other lighting data sheets already available on a national basis. The national sheets are still used. The new sheets, however, are designed to interest New Orleans people in the value of Planned Lighting by showing them specifically what other New Orleans people have done in their own places of business.

The first local lighting data sheet was printed about three years ago. Since that time 33 others have been printed.

Case Histories . . . Perhaps the best way to show the value of such a lighting tool is to quote from the case histories of a few of the lighting jobs in which they have played a part.

On December 26, 1950 a copy of the Data Sheet showing the installation of fixtures at United Fruit Company was given to the office manager of a local steamship company. Previous repeated discussion on lighting had failed to arouse interest.

The office manager was so impressed with the data on the local lighting data sheet that he made an appointment with the building manager of United Fruit Company to see the installation. Result: Request for a lighting layout ended in a completed Planned Lighting job. Continuous rows of fluorescent fixtures now give 65 ft-c of illumination in the office area. (previous illumination was 8 ft-c). Increased kw was 5.2.

Office Lighting . . . The lighting data sheets on office lighting interested the owner of a local finance company. A 45 ft-c installation using 8-ft slimline fixtures was installed.

A lighting data sheet showing window lighting was

(*Continued on page* 174)

WE MAKE OUR OWN RAIN . . .

Victor No. 245-R Transmission Pintype undergoing standard EEI-NEMA wet flashover test in the Victor Laboratory.

TO GIVE YOU

PROVEN WET WEATHER PROTECTION

The superiority of Victor design and manufacture is proven in the laboratory as well as in the field. Take Victor High Voltage Pintypes, for example. Here, in the wet flashover test shown above, the insulator is being subjected to controlled artificial rain while 60-cycle current is applied in gradually increased voltage steps until flashover occurs.

This is only one of the many tests which are constantly being made in the Victor Testing Laboratories to assure you of highest quality and conformance to specifications. That is why Victor Transmission Pintypes give you proven wet weather protection and longer, trouble-free service on your lines. Choose Victor — the power man's best buy!

VICTOR No. 245-R
EEI-NEMA Class 56-3

FREE BOOKLET gives you the full story of how Victor Insulators are made — how and why Purified Porcelain was developed. Write us for your copy.

Specify

VICTOR INSULATORS!

VICTOR INSULATORS, INC., VICTOR, N. Y.

Low and High Voltage Pintypes • Suspensions • Guy Strains • Spools • Switch and Bus Insulators • Custom Designed Porcelain

The Rolling Schoolroom . . .

Your Kearney demonstrators are equipped with ALL Kearney tools to show your linemen how to work better, faster, SAFER.

THOMAS H. BOWEN

GEORGE E. LEWIS

ROBERT C. SMITH

ALVIN W. KOHLER

WAYNE M. PEDERSON

Your Crews will work Faster and Better

Is your load growth causing growing problems in line repair and maintenance? Modern loads may have outmoded your older hot line tools, causing your crews to work under unnecessary hazards and handicaps.

One way to be sure of getting the most from your maintenance crews is to equip them with modern KEARNEY Hi-Line Equipment . . . designed and tested to meet the need of modern energized lines. Kearney Hi-Line Tools are built by men who recognize that SAFETY IS FIRST in equipment of this kind and have let this philosophy guide their thinking as the pioneer manufacturers of hot line tools.

FOR COMPLETE INFORMATION

on how KEARNEY equipment can help you maintain uninterrupted service with the greatest safety and efficiency, write for your FREE copy of Bulletin 18.

20 TIME-SAVING TECHNIQUES

for making safe, efficient hot line replacements and repairs are described in this handy, pocket-size book for linemen. We'll be glad to send a FREE copy to each of your linemen. Simply mail us a list of their names.

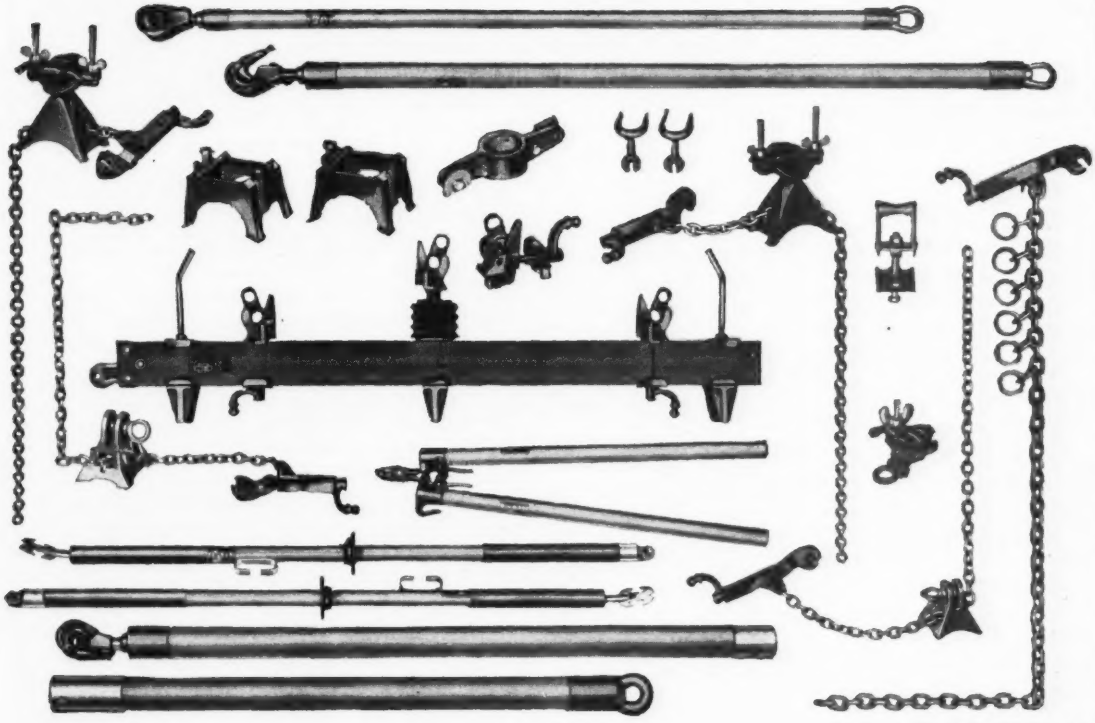
Specify **KEARNEY**

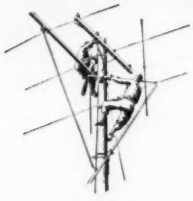
when they work Safely

with **KEARNEY**

Hi-LINE Tools

Designed to Fit Today's Heavier Loads . . .





Most hot line work involves replacing insulators, poles, crossarms, etc. For your convenience and economy, KEARNEY equipment has been grouped into sets for handling these jobs. Above is a Rural Line Set, specially designed to maintain rural lines safely and economically without service interruptions. Insulators, crossarms, poles and hardware on two, three and four conductor circuits can be replaced with this set. In addition, it is ideal to obtain the clearances required for maintaining transformers, cutouts, lightning arresters, as well as general inspection work. All wood units are tested to 75,000 volts for a period of five minutes.

JAMES R. KEARNEY CORPORATION

4224-42 Clayton Avenue,
St. Louis 10, Mo.

Canadian Plant:
Guelph, Ontario

JAMES R. KEARNEY
CORPORATION
ST. LOUIS, MO.
GUELPH, ONT.

Products *FOR BETTER CONSTRUCTION . . . FOR SAFER MAINTENANCE*

246

Data Sheets

(*Continued from page* 170)

discussed with a customer. Result: Lamp holders and floodlights were purchased and installed the same day.

A customer was about to install 10 bare lamp fixtures. Using local lighting data sheets as the basis of discussion, he was persuaded to change his plan. He now has purchased and installed 10 shielded fixtures.

A clothing store owner was shown several local lighting data sheets. He not only installed a Planned Lighting job in an addition to his store but also replaced all his bare lamp fixtures in the original area. His entire store now is well lighted in accordance with a Planned Lighting layout.

Through the use of the local lighting data sheets an office manager requested a layout. The job has been installed exactly as recommended.

Field Men . . . The utility field men like to use the local lighting data sheets. Their own comments listed below illustrate the point.

"I use the 'Data Sheet' whenever I discuss lighting with a customer and yet I have to find where it has failed to create interest."

"I also have found the 'Data Sheet' very helpful on cold canvass calls to focus the customer's attention on lighting and at least lay the seed which I feel will some day sprout into a relighting job."

"Two lighting jobs installed within a few days of each other have convinced me that I have a powerful tool in the 'Data Sheets' ".

"The 'Data Sheets' have been a major help in enabling me to lead a discussion into lighting channels and in assisting me to close the job."

"The 'Data Sheets' are a material aid in explaining a layout to a customer."

Complete Story . . . The New Orleans Lighting Data Sheets are designed to give a complete story of each lighting job illustrated. They are worded in simple non-technical language. The make-up is in four parts on the front page of each sheet and consists of:

1. The statement of the lighting problem.
2. The solution.
3. The customer's own statement of his reaction to the lighting job in terms of advantages to him.
4. A photograph of the installation.

The back page of each data sheet gives briefly:

1. The advantages of Planned Lighting.
2. Recommended amounts of illumination.
3. Color recommendation.
4. Advantages of proper and regular maintenance.

Four Types . . . Depending on the subject matter of the specific lighting data sheet, the wording of the back page is directed toward four types of lighting, **namely:**

1. Store lighting.
2. Industrial lighting.
3. Office lighting.
4. School lighting.

Various Uses . . . The data sheets are used in various ways as follows:

- A set is included in each field representative's sales manual.
- A supply of loose sheets is carried by each field representative.
- The sheets are used with the customer whenever lighting is discussed.
- Representative sheets are left with the customer for his own study at his leisure.
- Representative sheets are attached to each lighting layout delivered to the customer.

In all cases, the customer is invited to call on the business place illustrated in the Data Sheet and obtain at first hand the other customer's reaction to his own lighting. Where possible the utility representative offers to accompany the customer.

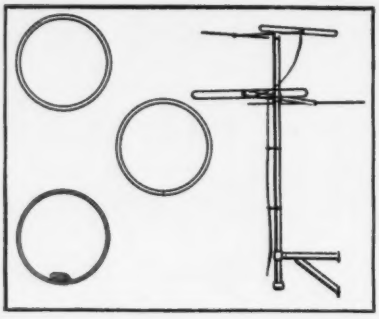
Presentation Folder . . . In addition. a presentation folder containing a complete set of the sheets has been given to each architect, consulting engineer, dealer and contractor within the limits of New Orleans. The presentation folders have a special cover wherein New Orleans Public Service Inc offers to send additional data sheets as they are published.

It is hoped that within a reasonable time after the data sheets are publicized with our lighting allies in New Orleans that the others selling or designing lighting will use the data sheets as freely with their customers or clients as the utility representatives use them with their lighting prospects. Some already are so doing.

Unit Cost . . . The sheets are printed in sets of four by local printers at a

Advertisement

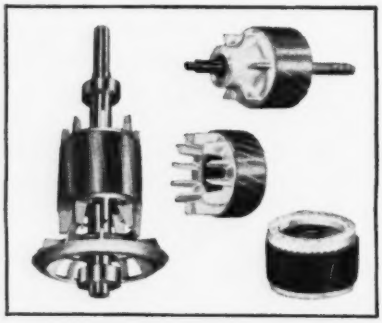
Electrical Applications of Aluminum



Superior TV Antennas

Check off what a television antenna requires —and you'll come up with an aluminum answer. Light weight, structural strength, excellent conductivity (pound for pound aluminum has double that of copper), freedom from rust and corrosion—these are a few of the aluminum advantages that are particularly important in TV antennas. Reynolds supplies many types of aluminum tubing as well as other forms of aluminum to manufacturers of antennas, masts and other electronic equipment.

Write to Reynolds at the address on the facing page for more complete information on the subjects above and also for details on the many other electrical applications of aluminum.



Better Motor Rotors

Many electric motor manufacturers are now die casting their rotors in aluminum. These rotors are not only excellent conductors of electricity, but the conductivity can be accurately controlled within close limits and at lower manufacturing cost.

The light weight of the aluminum rotors allows these motors to pick up fast. It also makes possible the casting of associated motor parts, such as fans, in a single piece with the rotor.

Aluminum is easy to cast. The metal follows and fills out complicated designs without leaving cavities or cracks. Reynolds furnishes aluminum rotor metal in aluminum pigs at various compositions.

ANOTHER RIVER EASILY CROSSED with REYNOLDS ACSR and REYNOLDS ELECTRICAL ENGINEERING SERVICE

Reynolds Electrical Engineering Service recently had a particularly difficult river crossing problem presented to them by a Missouri consulting engineering company*. Reynolds engineers recommended the most suitable conductor size; suggested structure heights and clearances; prepared drawings showing position of conductor at 60°F final; prepared special stringing sag tables for the conductors and for steel overhead ground wires with coordinated sag. These services, as well as others that may be required, are available without charge to Reynolds cable customers to help achieve the best in design and construction of overhead lines.

This experienced engineering service, plus the savings in original cost, handling costs and field costs offered by Reynolds ACSR, make a combination that is well worth looking into. Remember—Reynolds engineers will also be glad to meet with your men and present design and fabrication information on all electrical applications of aluminum.

*Name on request

ACSR MANUAL FOR ENGINEERS CONTAINS COMPLETE BASIC INFORMATION, CHARTS AND TABLES. This book is available without charge when requested on your business letterhead.

For information on specific problems

see your Reynolds distributors listed below or write direct to Reynolds Metals Company 2584 South Third Street, Louisville 1, Kentucky

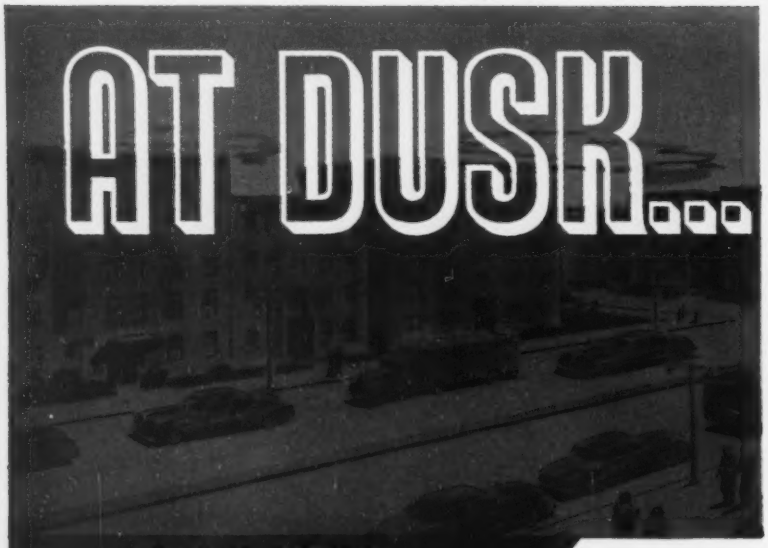
A. A. Electric Supply, Chicago • California Electric Supply, San Francisco
General Electric Supply Co., Bridgeport (and branches) • Hendrie & Bolthoff, Denver
Hughes Electric Supply, Orlando • Maydwell & Hartzell, Inc., San Francisco
San Antonio Machine & Supply Co., San Antonio
thern Electric Equipment Co., Atlanta • Chas. L. Ward Co., Kansas City, Mo.
Westinghouse Electric Supply Co., New York City (and branches)
Williamson Sales Co., Shreveport, Dallas and Houston

See "Mister Peepers" Sundays on NBC-TV. Consult local listing for time and station.

REYNOLDS ALUMINUM

MODERN DESIGN HAS ALUMINUM IN MIND

AT DUSK...



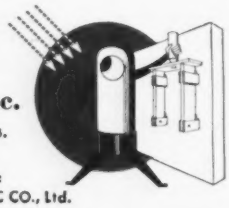
...FISHER-PIERCE
PHOTOELECTRIC CONTROL

When street lighting is controlled by Fisher-Pierce, lights *automatically* turn on the instant that natural light intensity falls below a safe level . . . regardless of time of day, season, climate or weather conditions. And, at dawn, lights remain on until natural light is sufficient for safety. No matter how modern your street lighting is, it is not adequate unless the lights are *on whenever natural light is insufficient for safety and protection.*

Fisher-Pierce Photoelectric Controls have been proven by the experience of hundreds of utilities — proven for performance, for technical operating features and for true economy.

When you consider augmenting or modernizing your street lighting, get in touch with Fisher-Pierce. The extensive Fisher-Pierce engineering service organization is at your service.

Write for Bulletin 63300C.



FP **The FISHER-PIERCE CO., Inc.**
82 Pearl St., So. Braintree, Boston 85, Mass.

EXPORT: PHILIPS EXPORT CORP.
100 E. 42nd STREET
NEW YORK 17, N.Y.

IN CANADA:
NORTHERN ELECTRIC CO., Ltd.

cost of approximately 10 cents each in quanties of 500.

The price is comparable to the cost of direct mail. However, the use of the data sheet is a rifle shot to a particular target compared to a broadside of scatter shot to an uncertain mass of possible targets.

It is planned to continue their use indefinitely and print at least 12 new ones each year. As time goes on the older ones will be discarded so that the ones in use always will be of recent vintage.

New Guide . . .

. . . for home lighting published by Illuminating Engineering Society

A completely new standard guide for home lighting, the "I.E.S. Recommended Practice for Residence Lighting," has been published by the Illuminating Engineering Society. The new 44-page, fully-illustrated practice was prepared by an I.E.S. committee comprised of home lighting experts from light companies and equipment manufacturers, and results from several years of discussion and study.

The new "I.E.S. Recommended Practice for Residence Lighting" is primarily devoted to the basic lighting requirements for family activities involving close vision, such as the selection and placement of portable lamps for sewing, reading, reading in bed, desk work, piano playing, kitchen and laundry activities.

Because interior finishes and their reflectances have a decided influence upon attractiveness, visual comfort and lighting efficiency in the home, as well as elsewhere, included in this new report is a special feature in the color-chip chart showing a suggested range of 30 colors, and their reflectances, for ceilings, walls and floors.

Prepared in an interesting and readable style, complete with subject index and appendix, the new manual is valuable for the guidance of architects, interior decorators and designers, portable lamp designers, educators, and others concerned with residence lighting, as well as for the professional lighting engineer and specialist. Individual copies are $1 and may be purchased from: Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

Test after Test

has proved the PENN-TAP'S

Unequalled Strength

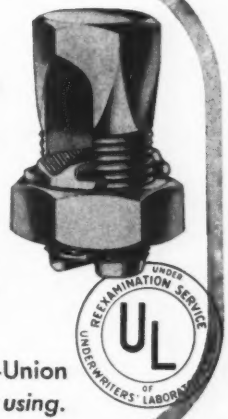
No other fitting of this type has matched the Penn-Tap in tensile strength, in numerous tests to destruction. The reason is obvious:

The Penn-Tap is more sturdily constructed . . . exceptionally tough silicon bronze alloy and *more of it* (at no added cost).

For taps, service entrance connections, dead ends . . . indoor or out. Quickly installed with ordinary wrench.

ONE PIECE—no loose parts . . . swivels on one locked bolt. Holds tight permanently. 7 sizes, for cables 10 Str. to 1,000 MCM.

Only one other Split Bolt Connector can take as high clamping pressures as PENN-UNION



Hundreds of competitive torque tests, of Penn-Union Split Bolt Connectors against other fittings of this type, have shown:

The Penn-Union Connector is *definitely stronger than all others except one, which closely follows Penn-Union design and is nearly equal.*

Excepting this one similar fitting, the Penn-Union Connector withstands clamping pressures 15% to 55% higher.

MAKE THESE TESTS YOURSELF. We will gladly furnish sample Penn-Union Connectors for tests against any other make. *Just tell us the sizes you are using.*

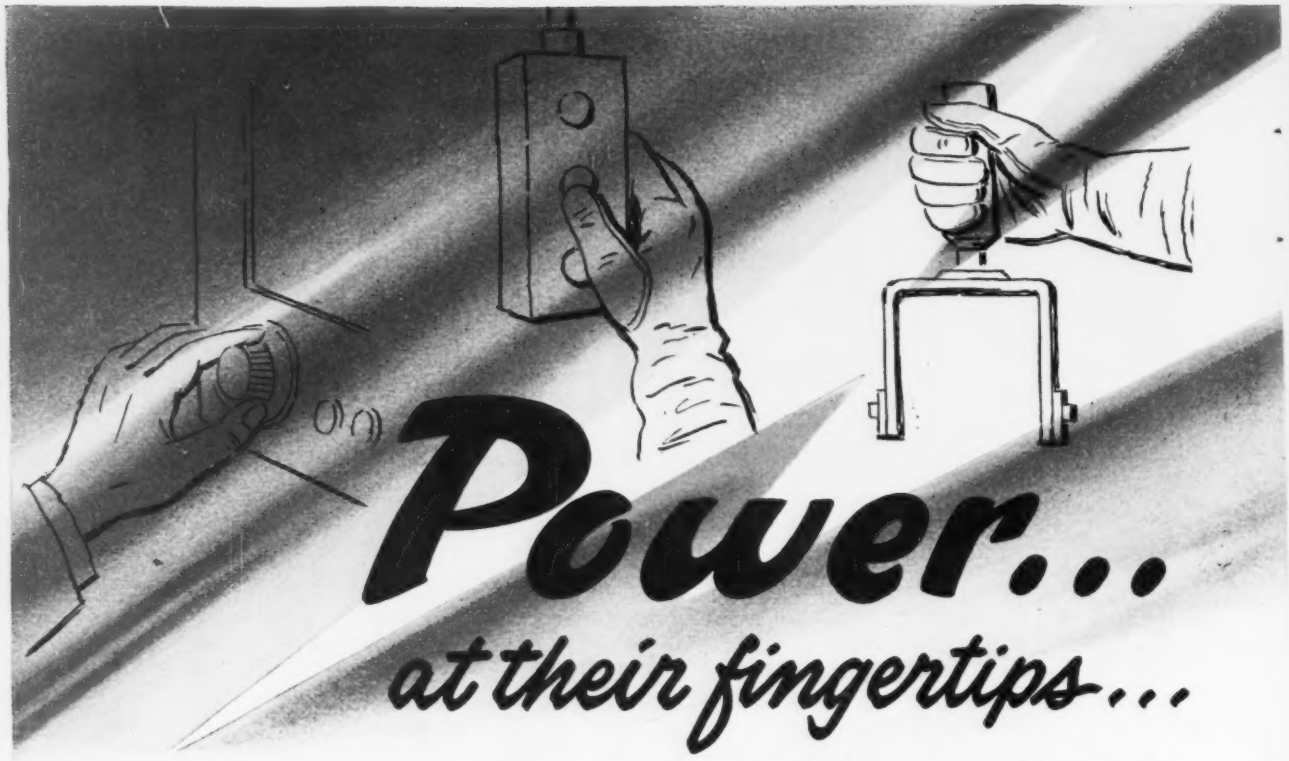
Sold by Leading Wholesalers

PENN-UNION ELECTRIC CORPORATION • ERIE, PA.

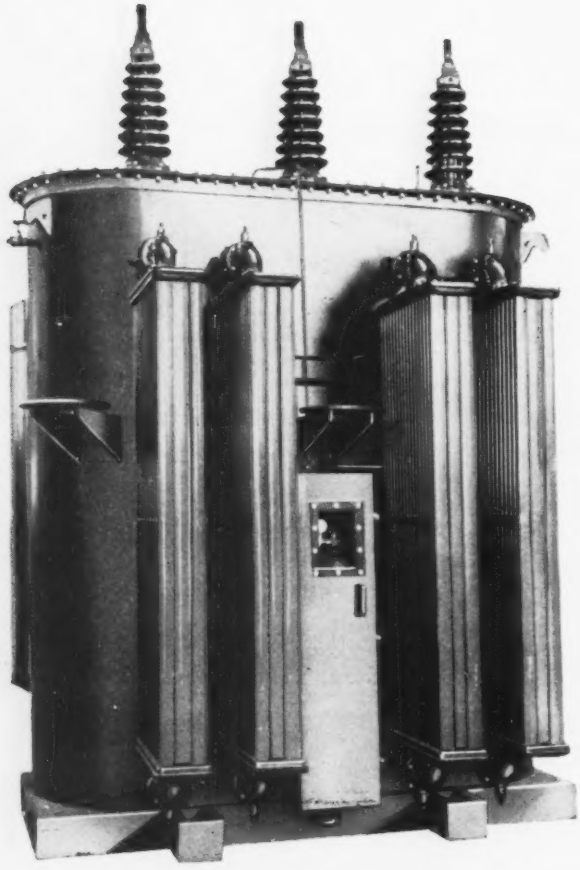
Canada: Dominion Cutout Company, Ltd., 250 Richmond Street, West, Toronto

The *Complete* LINE of CONDUCTOR FITTINGS

PENN-UNION



Power... at their fingertips...



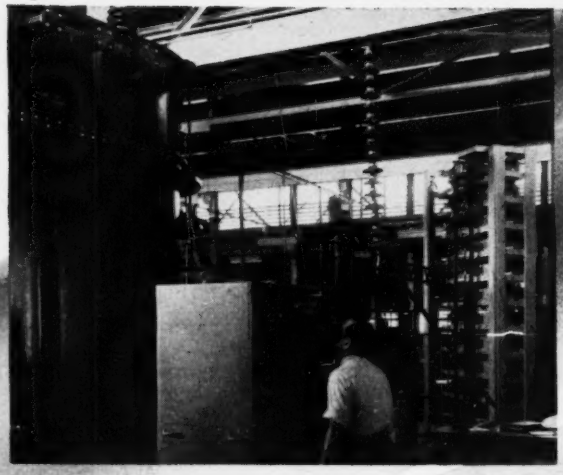
- Industries, commercial establishments, whole families all depend on reliable electric power as a motivating force for good production, effective lighting and essential home comforts.

For 36 years Standard Transformer engineers, working with utility company engineers, have designed and manufactured better transformers for more efficient use and dependable channeling of electric power. Service records, dating years back, prove the dependability; the economy; the low maintenance cost of STANDARD Power Transformers.

STANDARD Power Transformers are embodied with compactness of design, inherent strength and exceptional stability. Manufactured with extreme care, STANDARD Power Transformers are built to your specifications. STANDARD engineers, working with your engineers, arrive at the best construction and design for your particular needs. Normal loads . . . and overloads can be handled again and again whenever emergencies arise.

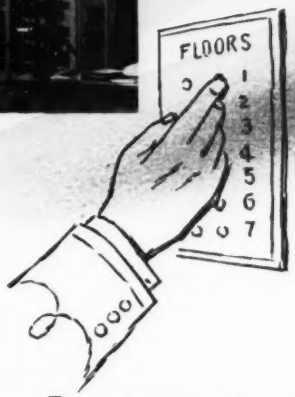
There's a Standard Transformer representative near you. Call him. Have him help you with your power transformer installation.

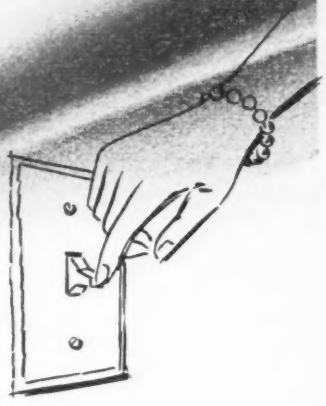
STANDARD Type AT, OISC Power Transformer, 7500 KVA, three-phase, 60-cycle, 66,000 to 13,800 volts, gas-seal construction, equipped with lightning arrester mountings and arranged for addition of forced air cooling.



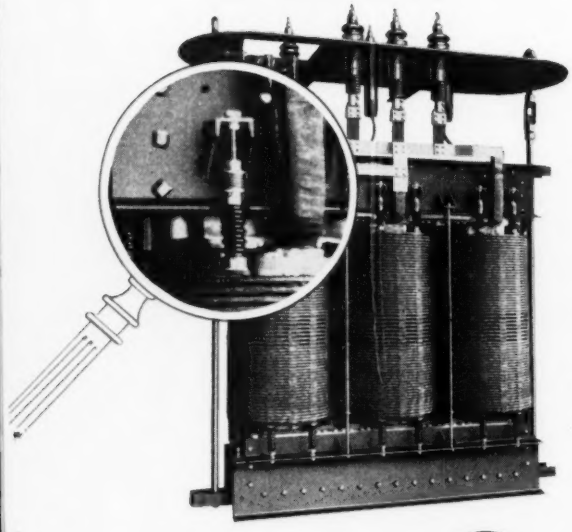
TESTING

This man is impulse testing a large Power Transformer in STANDARD'S modern plant at Warren, Ohio. A surge generator, with a range of one million volts, is used for ASA and NEMA standard and front-of-wave-impulse tests. Each transformer, no matter what the size, is subjected to standard commercial tests—both during manufacture and at completion. Experienced, thorough testing and inspection assure you of the finest transformer performance.



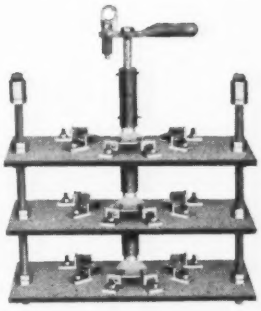


PUT THERE BY *Standard* TRADE MARK POWER TRANSFORMERS



TAP CHANGER ➡

STANDARD'S specially designed three-deck tap changer switch is externally operated without excitation. It also has positive contact with wiping action which has proven dependable for many years. Normal settings are with a 4-tap voltage selection . . 2½% taps within 10% range of normal rating. STANDARD supplies transformers with 4 taps above or below, or half above and half below as specified by the customer at no extra cost. Contact-making points are submerged in oil.



⬅ CORE AND COIL ASSEMBLY

This view shows the low voltage side of the core and coil assembly of a Power Transformer. Note STANDARD'S special design spring bracing with compression-type porcelain insulators on high voltage coils to compensate for the movement of coils during short circuit. It also compensates for shrinkage of the coil in operation.

THE *Standard* TRANSFORMER CO.

WARREN, OHIO

REPRESENTATIVES IN PRINCIPAL CITIES

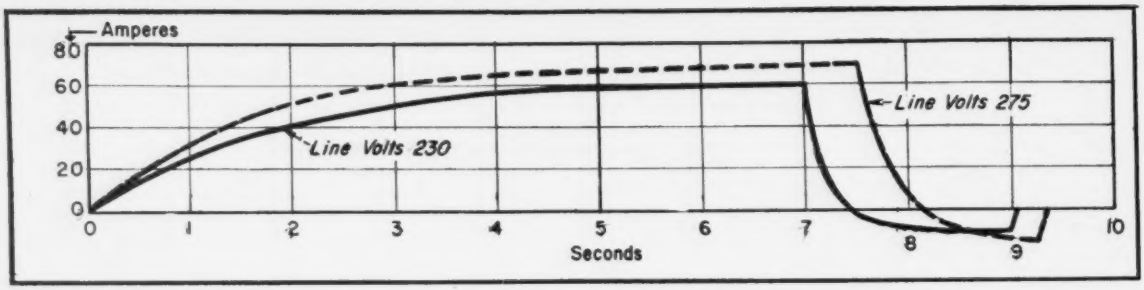


FIG 1—BUILD-UP AND DECAY for a 55-in. magnet operating at 230 and 275 v. Steady-state current of 60 amp is obtained in five sec at 230 v and decays in two sec. At 275 v, steady-state current of 70 amp is attained after six sec and decays in two sec

Can Lifting Magnets Be Supercharged?

ANSON M. HOLCOMB, Electrical Engineer, Bay City, Mich.

In cold climates, and in cool weather in warm climates, satisfactory service might be expected of supercharged (operated at above normal voltage) electric lifting magnets. However, if operated anywhere during hot weather, overheating may result.

The increase in lift produced by supercharging depends on the type of material and on the operator. If the voltage is held at a value which does not overheat the magnet, the material handled would be about the same and complications avoided.

One method of holding the temperature down is to put a resistor in series with the magnet and shunt it with a contactor which is closed while the current builds up and opened by a time or current relay when the current reaches full or nearly full value. Other ways, such as field control, can be used, but the resistor method is typical.

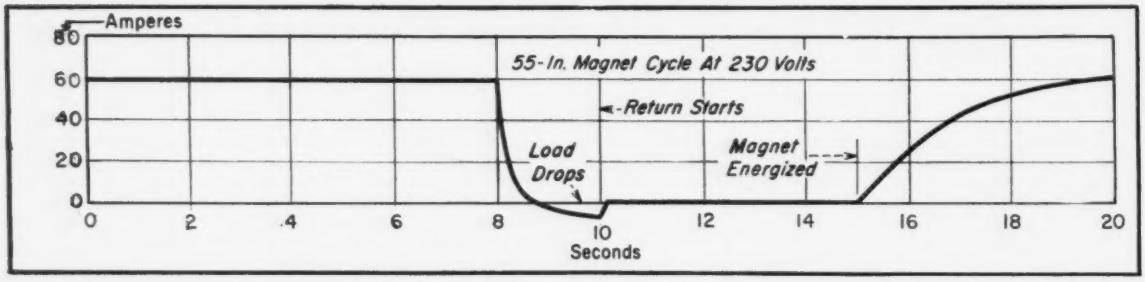
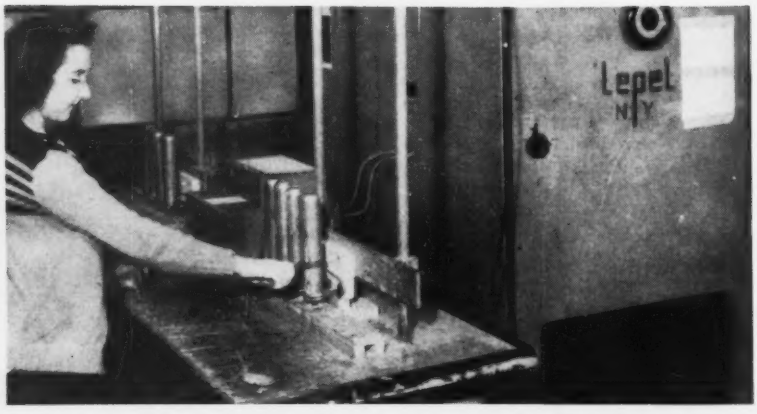


FIG 2—DUTY CYCLE is illustrated for a standard locomotive crane with a 50-ft boom having rotating, hoisting, and traveling motions, and operating at 230 v. Note that the current is full strength for eight sec and part strength for two plus five sec

Induction Heating Solders Parts Automatically



SOLDERING DEHYDRATORS is done easily and with ideal working conditions with this 30-kw induction heater. After operator starts heater, operation is performed automatically

C. L. STAPEL, Industrial Representative, Duquesne Light Co, Pittsburgh, Pa.

The problem of soldering refrigeration and air conditioning dehydrator parts at Superior Valve & Fittings Co, Pittsburgh, Pa., was solved by the installation of a 30-kw induction heater.

It was selected for this operation because of its ease of application. It also facilitates production, and working conditions are favorable when the heater is being used. The parts to be soldered are pre-assembled. Flux and a ring of solder are applied before they come to the induction

(*Continued on page* 184)

When you're

LIMBING FOR CLEARANCE

CLEANING UP BLOWDOWNS

FELLING DEADWOOD HAZARDS

CLEANING RIGHT OF WAY

You will be—Eager as a beaver for a Luther portable, one man, power driven chain saw—Not so light it's a toy—magnesium and aluminum makes Luther lighter than ever before thought consistent with efficient performance.

Not as low cost as the cheapest—only $25.00 more buys the Gilmer reduction chain drive that never falters at jobs that have burned out a direct drive motor.

But Luther also cuts twice as long on a tank of fuel—15 more trees per quart. Cuts as low as 1 inch stumps—"Sure-fire" automatic rewind starter with exclusive nylon cord—waterproof ignition not affected by rain or snow—up, down or sideways, carburetor works in any cutting position—gives more, easier cutting per dollar than any like saw.

LUTHER ENGINE

Div., Luther Corporation
Williams Bay, Wisconsin

LUTHER

$249.50 list

HERE'S A STORY EVERY PLANT OPERATING MAN SHOULD READ

"Heating in our main switch was causing Shutdowns But we stopped them cold by changing to Fusetron dual Element Fuses"

"In the Fall of 1951 in our cafeteria, we installed a new 1200 ampere switch. This switch controlled the lighting, refrigeration and a 115 ton air conditioning load.

"Everything was fine until the temperature reached 85 degrees and the summer air conditioning load came on. Then we had trouble.

"Three times in May, 1952 during our noon rush our whole place was shutdown.

"Our dining rooms seat 500 people at a time, so you can see what a shutdown during the noon rush means to us.

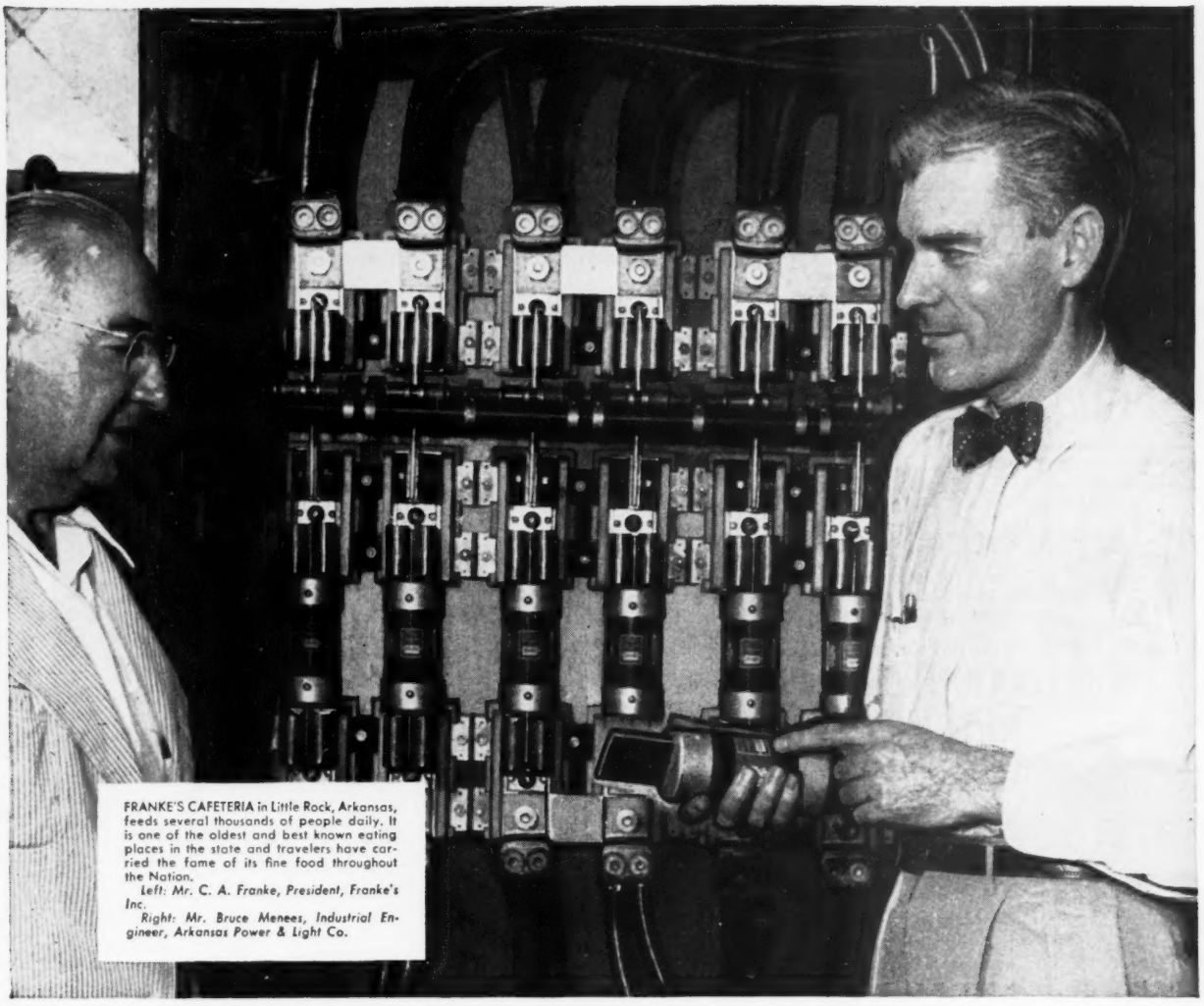
"We were fighting mad about the whole affair as the installation was practically new. Mr. Menees of the Arkansas Power and Light Co. was called in.

"He suggested that the trouble was due to the adding of the summer temperature to the normal heating of the fuses. Then he recommended that we discard our ordinary fuses and install FUSETRON dual-element fuses, as these modern fuses operated at a much cooler temperature than other fuses.

"This we did. To date, June 19, 1953, over one year since we made the change we have not had a shutdown due to a fuse blowing even though today's temperature outside is over 100 degrees.

"The cooler operation of FUSETRON fuses stopped shutdowns cold for us."

C. A. Franke, President
Franke's Inc., Little Rock, Ark.



FRANKE'S CAFETERIA in Little Rock, Arkansas, feeds several thousands of people daily. It is one of the oldest and best known eating places in the state and travelers have carried the fame of its fine food throughout the Nation.

Left: Mr. C. A. Franke, President, Franke's Inc.

Right: Mr. Bruce Menees, Industrial Engineer, Arkansas Power & Light Co.

You too, can profit by the 10 POINT PROTECTION of FUSETRON dual-element FUSES

FUSETRON is a trademark of the Bussmann Mfg. Co., Division of McGraw Electric Co.

1 *Protect against short-circuits.

2 Protect against needless blows caused by harmless overloads.

3 Protect against needless blows caused by excessive heating—lesser resistance results in cooler operation.

4 Provide thermal protection—for panels and switches against damage from heating due to poor contact.

5 Protect motors against burnout from overloading.

6 Protect motors against burnout due to single phasing.

7 Give DOUBLE burnout protection to large motors — without extra cost.

8 Make protection of small motors simple and inexpensive.

9 Protect against waste of space and money — permit use of proper size switches and panels.

10 Protect coils, transformers and solenoids against burnout.

*Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York.

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

FOR MORE INFORMATION *use this Coupon*

BUSSMANN Mfg. Co. (Division of McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.

Please send me complete facts about FUSETRON dual-element Fuses.

*Name*_____

*Title*_____

*Company*_____

*Address*_____

*City & Zone*_____ *State*_____ EW-1253

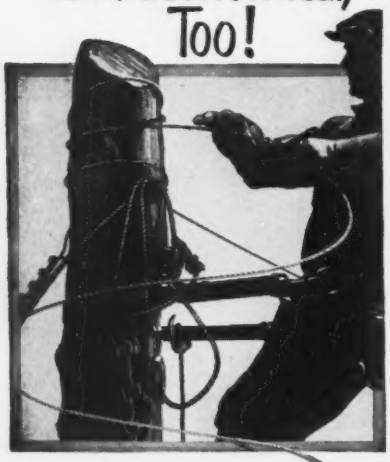
Crapo
GALVANIZED STEEL
STRAND

Strong...
to support pole structures under adverse ice and wind loadings.

Rugged...
to withstand the punishment incurred in construction and service.

Long-Life...
provided by famous Crapo Galvanized heavy, ductile, tightly-bonded zinc coatings.

-and Economical, Too!



● Each size and grade of time-proved Crapo Steel Strand utilizes the superior tensile strength of steel to the fullest advantage. Next time, *specify Crapo Steel Strand* for guys, messenger and overhead ground wires . . . and *save on maintenance!*

REINFORCE and PROTECT YOUR CONDUCTORS with Preformed ARMOR RODS

Minimize wear and chafing . . . Absorb and dissipate vibration . . . Protect against arcing and flash-overs . . . Increase holding power against slippage . . . Lessen possibilities of corrosion . . . *Reduce overall maintenance costs.*

Contact your jobber of Crapo Galvanized Products or write direct for further information!

INDIANA
STEEL & WIRE COMPANY
MUNCIE, INDIANA

Soldering Parts

(*Continued from page* 180)

heater operator. The operator merely places the dehydrator in the coil, starts the heater, and removes the soldered unit from the coil. After the heater is started by the operator, the soldering operation is performed and the heater is stopped automatically.

The induction heater serves two stations consisting of four coils each. While four units are going through the soldering operation at one station, four completed hydrators are removed and four other units are placed in position at the second station. Electric power to the stations is controlled by a double-throw switch.

Infrared Dries Mats Faster

MOISTURE REMOVAL from printing mats with 12 - 500-w infrared lamps at the New Orleans Item has the following advantages over the system previously used: faster drying rate, greater worker comfort—heat is created only while the mats are drying, and less electrical energy consumed as the lamps are off except when mats are actually being dried. The dryer, is equipped with two banks of six lamps each. Each bank has its individual time control, pre-set to the number of seconds required to dry the saturated mats. J. M. Jennings, Jr, Industrial Engineering & Utilization Department, New Orleans Public Service Inc.

INDUSTRIAL BRIEFS

Heating shop offices electrically, readily solved a space heating problem at Seneca Wire & Manufacturing Co, Fostoria, Ohio. Since no other form of heat was available in the vicinity of the offices, two 3-kw space heaters with thermostatic control were installed. Since installation of the space heaters, employees have had no difficulty in keeping warm during the winter months, no matter how cold the weather. A secondary benefit to the company has been the great improvement in employee morale. R. T. Woodruff, Industrial Power Engineer, Ohio Power Co, Fostoria, Ohio.

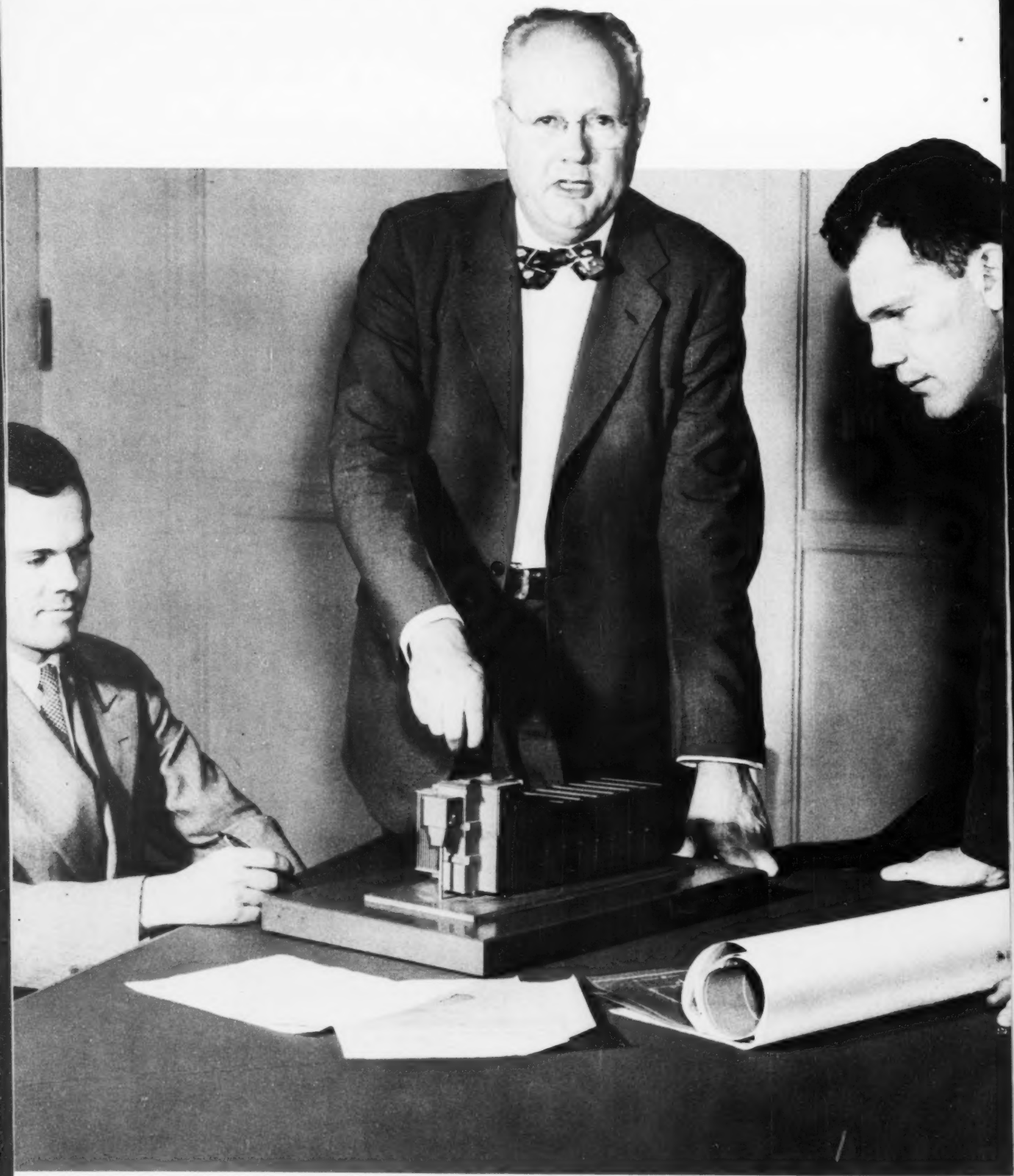
Baling tin cans with motor driven hy-

(*Continued on page* 197)

Meet F. N. McClure, Sponsor Engineer, Westinghouse Electric Utility Department. On the following 11 pages he shows how Westinghouse products are . . .

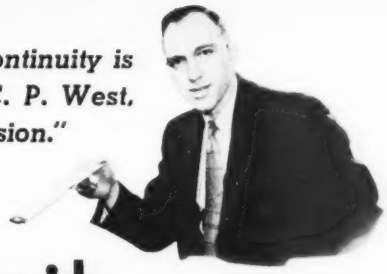
Helping you approach automatic service continuity . . . realistically

Frank McClure "sponsors" utilities in their engineering relationships with Westinghouse. As liaison with our Central District, he coordinates the engineering problems of his utilities with district and headquarters Consulting and Application Engineers. Frank has worked in all phases of utility problems including relaying, load-flow studies and Magamp development.



YOU CAN BE **SURE**... IF IT'S

"The foundation of automatic service continuity is in coordination of equipment. Here's C. P. West, Engineering Manager, Switchgear Division."



See how specialists provide the utmost in equipment coordination

When you order a Westinghouse unit substation, a whole staff of engineers goes to work on it—because we know your problem of automatic service continuity demands the utmost in coordination of transformation, regulation, relaying and switching. Years of designing and manufacturing unit substations has developed unusual proficiency in this operation.

Take the case where unit substations are connected into a primary network for a high degree of automatic service continuity. Working together, our relay, transformer and switchgear engineers have developed a complement of equipment that assures positive relay operation at low currents and associated voltage fluctuations.

This permits the use of unit substation transformers with Hipersil® cores, having low magnetizing current, without sacrifice of high performance fidelity on reverse current flow.

The critical problem of coordinating the tap-changing-under-load elements of a unit substation requires a close working arrangement between other switchgear, transformer and relay engineers. The operating and design characteristics of the tap-changing-under-load voltage regulating relay and compensating devices must be matched with those of the controlling potential and current transformers.

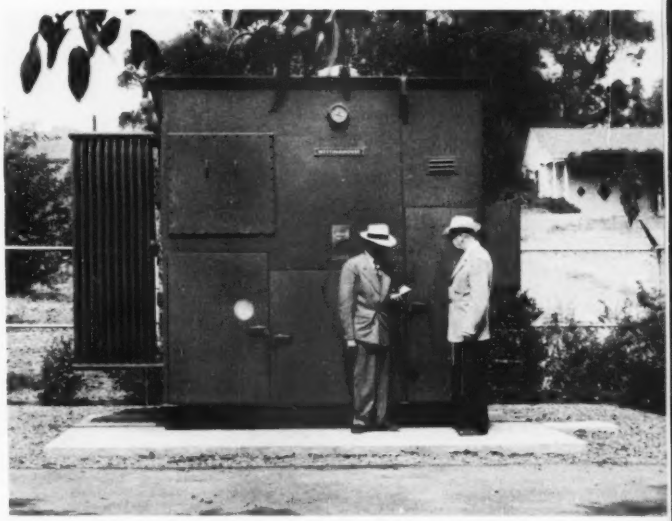
Similarly, the electrical characteristics of the tap-changing-under-load driving motor, the cooling fan and/or the cooling pump motors, and the auxiliary power required for operation of the associated circuit breakers must be matched and integrated to permit the most efficient use of the control power source. Here, too, the utmost in coordination is assured by the constant contact, within one organization, among the engineers responsible for the design of each of the components of the complete substation.

The thermal relays which protect the transformer against overloads are precisely designed and calibrated to simulate the loading of the transformer and properly operate to trip the associated breakers.

This greater assurance of complete coordination for automatic service continuity is another important factor to consider when you are planning to buy substations. Consider, also, the great flexibility of Westinghouse unit subs, the ease of installing, the ease with which new units can be added when loads grow or shift.

When you're thinking about new substations, call in Westinghouse early in your plans. And write now for informative booklet B-4061.

J-60835



For single-feeder service, the Westinghouse "CSP®" power transformer represents the ultimate in equipment coordination for automatic service continuity. Transformer, breakers, relays, lightning protection and tap-changing-under-load equipment are contained in one housing.

Westinghouse

"Westinghouse has studied the application of reclosers and sectionalizers, exhaustively, to provide automatic service continuity. Ken Niebauer* discusses . . ."

Automatic service continuity now practical in more rural and suburban areas

With the development of a complete line of Westinghouse low-cost reclosers and sectionalizers, it is now economically practical to extend automatic service continuity to more rural and suburban areas. Westinghouse can help you achieve the coordination required.

On many systems, reclosers are set for two instantaneous trips and two time delays to lock out. This provides for good fuse coordination because temporary faults will be cleared by the instantaneous operations, thereby saving the fuses.

This system has the disadvantage, however, of causing all the reclosers in series to trip on every fault, because it is impossible to coordinate reclosers on instantaneous tripping. This results in excessive operation of the reclosers.

Westinghouse reclosers make possible a better reclosing scheme because they can be set to trip on four time-delay operations. When a fault occurs, only the nearest recloser trips. This saves wear and tear on the others. This system works best with sectionalizers and it provides the ultimate in automatic service continuity for rural and suburban areas.

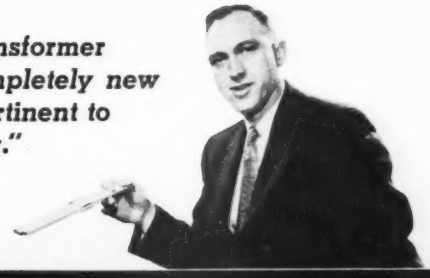
Westinghouse offers still a third scheme—one instantaneous and three time-delay trippings of reclosers. This reduces recloser operation as compared with the two instantaneous trip method and provides better fuse coordination than the four time-delay system. We would like to discuss automatic service continuity with you. Write for more data.

J-60837

*Mgr., *Fuse and Recloser Engineering.*

YOU CAN BE **SURE**...IF IT'S

"Here's Bob Ray, of the Transformer Division, to announce a completely new transformer development pertinent to automatic service continuity."*



New TX arrester triples current-clearing ability of "CSP" transformers

Three times the power-follow current interrupting capacity! That's the direct result of the new Type TX arrester now used on Westinghouse "CSP" distribution transformers. Here's how it's accomplished—

The new arrester design retains the high surge-current characteristics of previous arresters. But 60-cycle current-clearing ability is tripled by a "spiral-type" filler which stretches out the path for the 60-cycle current to effectively limit the flow of the dynamic current to less than ½ cycle. This new feature is another reason why "CSP" transformers can be installed *anywhere* on your distribution system.

The new 3-kv TX arrester is available mounted directly on the wall of the "CSP" transformer where it obtains maximum coordination with high-voltage bushings and the transformer insulation level. Higher ratings will be available shortly. Radio interference is reduced because the gap is on the line end and the arrester is not in the circuit unless discharging.

If you want realistic automatic service continuity at all points along your distribution system, make certain you investigate "CSP" transformers with the new TX arrester. Your nearby Westinghouse representative will be glad to supply full details.

J-70699

*Mgr., Distribution Transformer Sales.

Westinghouse

YOU CAN BE **SURE**...IF IT'S

"Mike Meixner, Manager, Regulator Sales, discusses a significant factor in obtaining automatic service continuity at the right voltage—"

Simplified "all-electric" regulation assures accuracy in automatic service continuity

The dependable accuracy of voltage regulation is one of the necessary factors in the approach of realistic automatic service continuity. This accuracy should be attained with simplified controls that are easy to adjust and maintain.

Westinghouse has provided the answer to this important consideration with the new all-electric control panel like the one shown. Here's how—

All moving relay parts are spring-hinged—eliminating troublesome mechanical bearings and possible friction drag. Metallic contact of the pole faces on the motor-operating relays has been eliminated through spring-supported, snap-action elements. It is impossible for the relays to stick because of residual magnetism. Contacts are heavy-duty silver, designed to last the life of the unit.

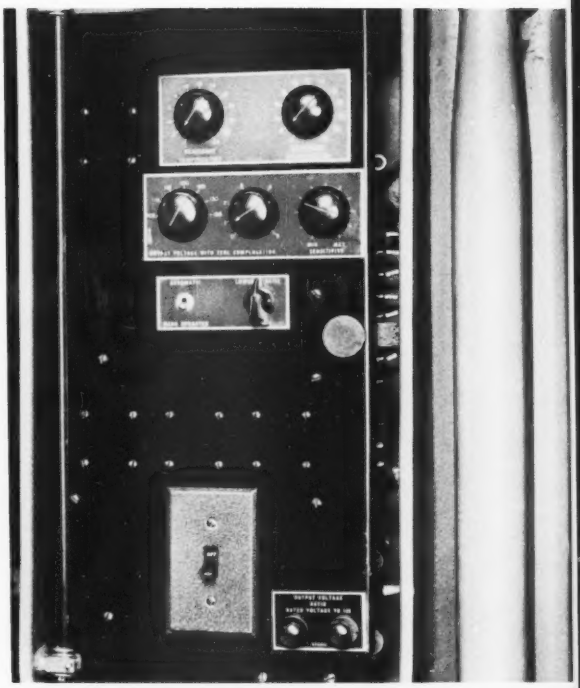
And, in addition, they're easy to operate. Your men can operate the Westinghouse all-electric control panel without complicated mechanical adjustments. No tools are necessary because pin-point accuracy is obtained by simply turning three knobs—all located for convenient accessibility on the front of the panel. The result is the smoothest possible regulation, with simplified, sensitive control.

All-electric control panels are typical of the outstanding design advantages found in Westinghouse regulators. Whether your requirement is in the low, medium or high range of voltages—you will find a Westinghouse regulator designed to meet your specific need.

When you're confronted with the problem of attaining a realistic pattern of automatic service continuity with accuracy of voltage level—remember to investigate Westinghouse regulators. Your Westinghouse representative is ready to serve you. And in the meantime, write for D.B. 47-310.

J-10406

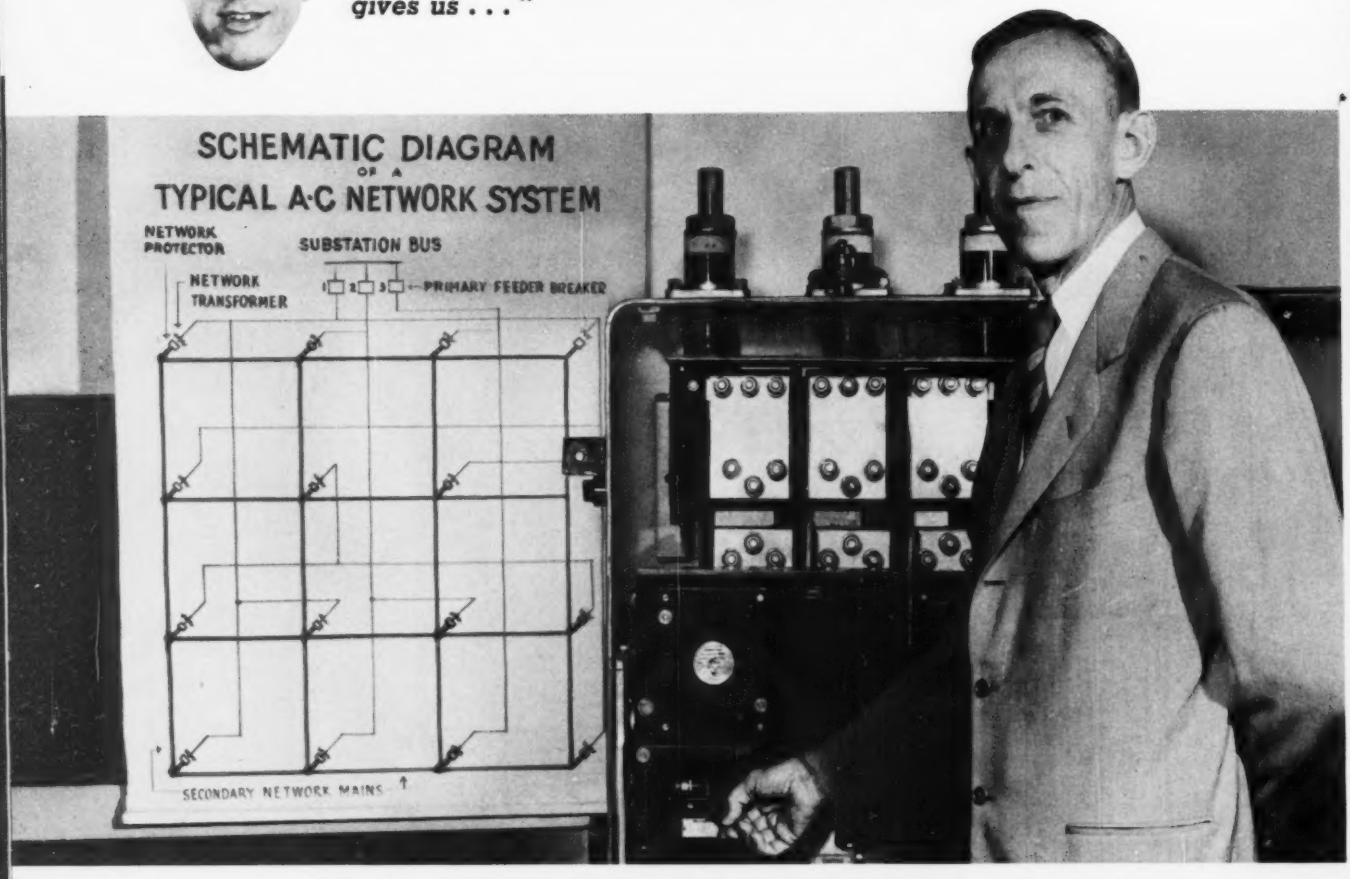
Westinghouse



All-Electric Control Panel. This close-up demonstrates the unusual simplicity of operation. Clearly calibrated voltage markings make it possible for any operator to make exact adjustments without the use of tools.

Voltage Regulating Relay completely eliminates mechanical adjustments. All settings are made by adjusting the knobs on the control panel. All moving parts in the relay are spring-hinged to eliminate mechanical bearings.

"Automatic service continuity is epitomized in the secondary network. George Grissinger, Manager of Network Protector Engineering gives us . . ."



Facts behind the exceptional service continuity of Westinghouse secondary networks

The ultimate in automatic service continuity is the a-c secondary network system . . . made possible by the network protector, an exceptional device pioneered by Westinghouse 30 years ago.

Network relays are the "intelligence" of each protector. The CN-33 master relay trips the protector automatically on reverse power flow (power flow from the network to the network feeder). The master relay and CNJ phasing relay automatically allow the protector to close if the power flow will be correct (power flow from the network feeder to the network).

Because network operation requires sensitive relays, Westinghouse has made relay adjustments easy to understand and easy to make. All adjustments can be made from the front of the relays without removing them from the protectors. Reverse current adjustments of 0.1% to as high as 10% of the rated protector current are obtainable on the master relay.

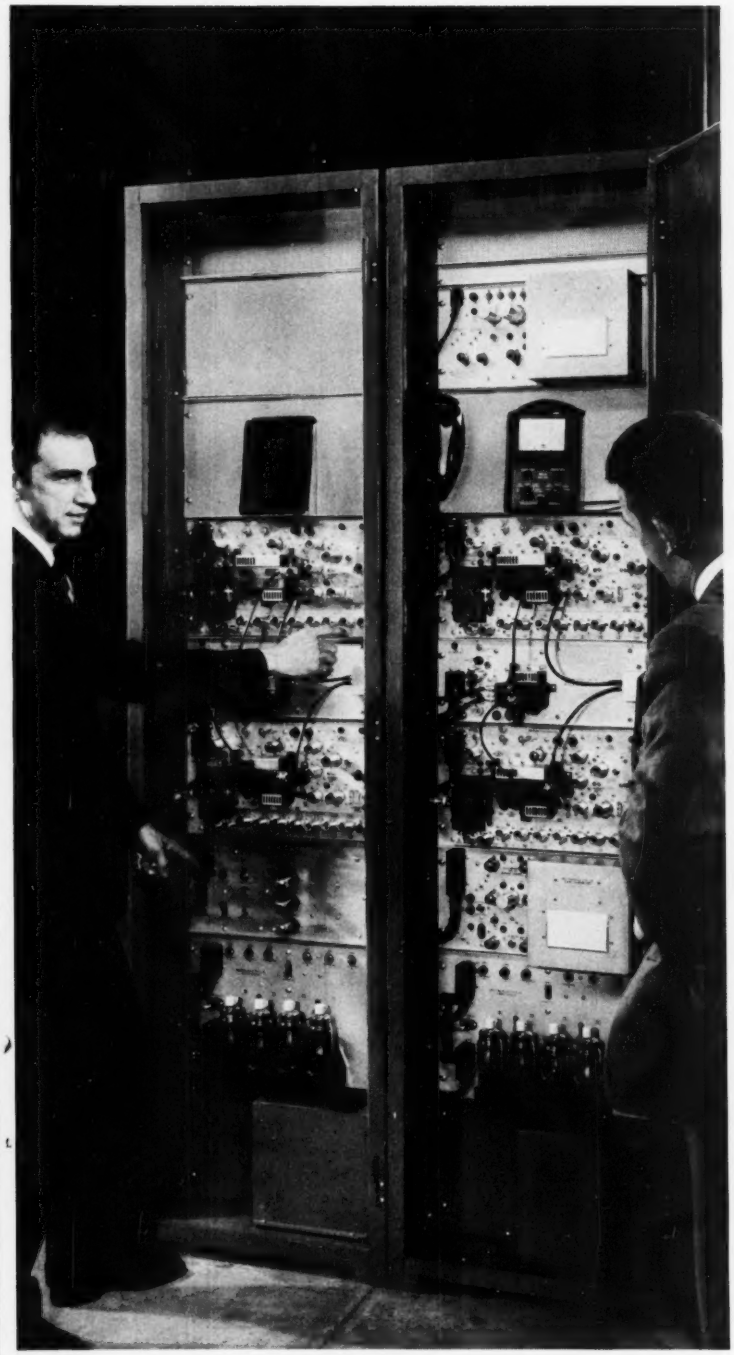
The sturdy construction, unusually high torque and unmatched performance of Westinghouse network relays insure network service continuity. "De-ion®" arc interruption gives fast and reliable clearing of system disturbances.

Get more information on this outstanding equipment which is so important to network operation. Write for Descriptive Bulletin 35-550 describing the operation of Westinghouse network protectors.

J-60836

YOU CAN BE **SURE**...IF IT'S

"Dependable communications and control are vital to service continuity and Carl Suhrstedt tells how . . ."*



Two important factors make this microwave more reliable

This is the Westinghouse 2,000 MC microwave with up to 30 voice or 450 telegraphic channels. The reliability of these channels is protected in two important ways.

First, the multiplexing equipment, of the frequency division type, functions on the principle of distinct channel independence. If one channel develops a fault, all the other channels continue to operate without interruption. This long-term dependability of Westinghouse multiplex equipment is your greatest guarantee of reliable communications . . . for voice, supervisory control, telemetering, relaying and other functions.

As a second means of assuring service continuity, Westinghouse microwave offers stand-by radio equipment. When this equipment is used, it is automatically switched into the system if any fault develops in the radio equipment. It can be arranged for instantaneous or delayed switch-over.

When you are planning new or expanded communications and control, examine all of the specific benefits of Westinghouse microwave. The design is based expressly on utility needs and is derived from years of practical experience in microwave communications. Remember that Westinghouse makes both power-line carrier and end-use equipment so we are in an ideal position to discuss your needs without bias.

For more data, call your Westinghouse representative or write for booklet B-5850, Westinghouse 2,000 MC Microwave for Electric Utilities.

**Mr. Suhrstedt is Manager of Carrier-Microwave Application Engineering, Electronics Division.*

Westinghouse

"High-speed breaker reclosing is basic to automatic service continuity. Relay Application Engineer R. G. Lakin tells you about improvements in the RC reclosing relay . . ."

New preclosed relay contacts cut reclosure time 3 cycles

Now Westinghouse has achieved truly instantaneous reclosure of electrically operated circuit breakers with improvements in the RC reclosing relay. This high-speed action was made possible by the design of new *preclosed* contacts. Now it is possible to save the three cycles formerly required to energize and close a set of contacts.

When a fault occurs, overcurrent or other protective relays on the line open the breakers and energize the RC relay. Since the reclosing contacts in the RC relay are *already* closed, the RC relay acts instantly to close the breakers. The time saved is invaluable in saving important loads.

If a fault still exists after the instantaneous first reclosure of the RC relay, the equipment will make additional reclosures at suitably timed intervals. If the breaker does not remain closed after the final reclosure, it is locked out until the fault can be corrected.

Another feature provided by the redesigned RC relay is lockout of the instantaneous element in protective relays used with the RC relay. This is essential, for example, when fuses are used to protect branches of a main feeder. If a fault on a branch feeder does not clear with the first trip-out, the RC relay will lock out the instantaneous element in the protective relay, allowing the fuse to clear the fault on the next reclosure.

For more information on the RC reclosing relay, write for D.B. 41-310. J-40451

YOU CAN BE **SURE**...IF IT'S

"Bob McCollom, Transformer Application Engineering Manager, points out an exclusive feature in transformer manufacturing."

QC* impulse testing . . . exclusive proof of instrument transformer reliability

Automatic service continuity on a realistic basis is largely dependent upon instrument transformers—vital "links" between your lines and their controls. Not only must they meet accuracy standards but they must be absolutely dependable, as well.

That's why Westinghouse and only Westinghouse offers this proof. Simulating both normal and abnormal conditions they might be subjected to in service, Westinghouse surge tests instrument transformers on the production line.

This quality control testing assures that the required impulse strength has been built into the transformer—before it leaves the plant—and before service continuity can be effected.

And, as added measure of reliability, other features like Hipersil cores, oxygen-free copper, plastic impregnation and oil-vacuum processing make Westinghouse instrument transformers the most reliable and accurate transformers on the market.

When you're looking for a realistic approach to automatic service continuity, get full details on Westinghouse instrument transformers. Your local Westinghouse representative will be glad to cooperate. Call him today. J-70698

*Quality Control.

Westinghouse

"Constant product improvement is the key to better service continuity, and . . ."

The realistic approach to automatic service continuity starts here

Last year Westinghouse spent more money to improve products than was earned in net income. Some recent relay developments illustrate how these dollars contribute to service continuity and other utility problems. Take the RC relay, which automatically recloses circuit breakers. A new set of contacts has been added which enables the RC to do the work of *two* relays. These contacts can lock out the protective relays after the initial opening—until reclosing is completed. Previously this required separate auxiliary relays. Result: automatic service continuity is simplified.

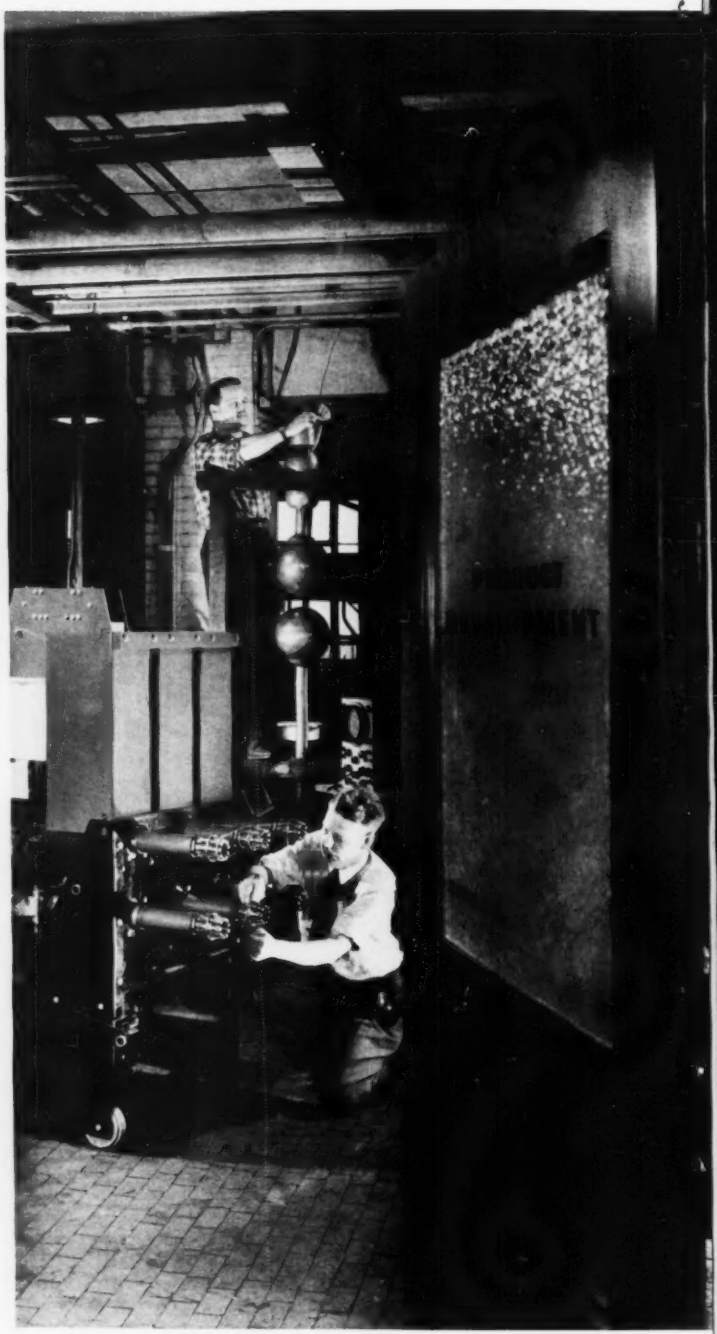
Ground relays that operate due to directional overcurrent have heretofore been polarized either by voltage or current. We made two kinds, and utilities stocked two kinds. Now we have developed the new HCRD relay which is polarized by *either* voltage *or* current, or both, eliminating stocking problems.

A major development, last year, was the introduction of the new Westinghouse overcurrent relay . . . the ultimate in accuracy, flexibility and reliability. Moreover, the new CO relay can be calibrated for inverse or very inverse time-current characteristics. This formerly required separate relays.

Westinghouse has over 200 individual laboratories making improvements like these. More are being built, including the $6,000,000 turbine laboratory at South Philadelphia, a new turbine-generator test floor at East Pittsburgh, an ultramodern research laboratory with constant expansion in the existing facilities. CP-1009

• • •

For more information on the products described on previous pages, write: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.



YOU CAN BE **SURE**... IF IT'S

Westinghouse

(*Continued from page* 184)

draulic press at V. P. Serodino, Inc, Cincinnati, Ohio, makes possible the saving of millions of cans for steel scrap in steel production. This machine kneads the cans into a compact, almost solid mass. Bales vary in size from 7 in. by 7 in. by 12 in. to 7 in. by 12 in. by 12 in. and weigh from 25 to 80 lb. Variable volume pressure pump is driven by a 50-hp, 480-v, 3 phase motor. E. H. Keune, Power Engineer. Cincinnati Gas & Electric Co, Cincinnati, Ohio.

Cutting nylon cord without fraying ends has been solved by E. T. Rugg Co, Newark, Ohio by use of an electrically heated knife. Power motor starter cords are cut and ends sealed simultaneously. Operating at temperature of approximately 1200 F, the cut is clean, the ends sealed and no charring results. Temperature of blade can be adjusted to fit work. D. E. Dome, Commercial Sales Rep, Ohio Power Co, Newark, Ohio.

Water heating at Savannah and Atlanta Railway, Savannah, Georgia, with 200-gal heater having two 5-kw immersion units has replaced coal-fired hot water boiler serving 75-man repair shop wash and shower room. This has saved four man-hours per day ($5.60) and always provides a trouble free ample supply of hot water. C. D. Anderson, Power Sales Engineer, Savannah Electric & Power Co., Savannah, Ga.

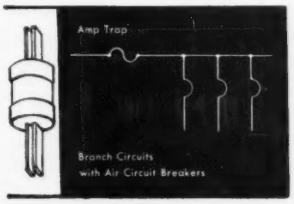
Heating water electrically to make and keep hot a soap solution for a wire drawing application, at Seneca Wire & Manufacturing Co, Fostoria, Ohio, provides the desired temperature of 100 F at all times. As no other form of heat was available in the immediate vicinity of the tank, two 4.5-kw immersion heaters with thermostatic controls were installed. R. T. Woodruff, Industrial Power Engineer, Ohio Power Co, Fostoria, Ohio.

Heating plating materials and cleaning solutions in small quantities for plating of lamps, teapots, etc., has been solved by the Turner Electroplating Co, Newark, Ohio, through use of 3-kw immersion heaters in the solutions. Accurate temperature control is provided, possibility of explosion eliminated, and less space required. D. E. Dome, Commercial Sales Rep, Ohio Power Co, Newark, Ohio

Amp-trap®

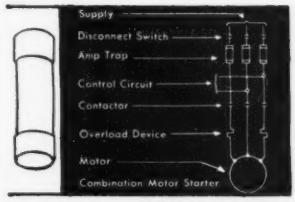
CHOPS DANGEROUS SHORT-CIRCUITS DOWN TO SIZE

Amp-trap with CIRCUIT-BREAKERS



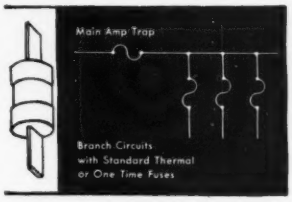
Amp-trap's lightning fast current limiting action makes it ideal for use in locations where the available short circuit current exceeds the circuit breaker's interrupting rating. It gives back-up, short-circuit protection to overload devices and clears a heavy short-circuit before the circuit breaker can open. Yet, the circuit breaker will open within its rating without blowing the Amp-trap.

Amp-trap with MOTOR CONTROLLERS



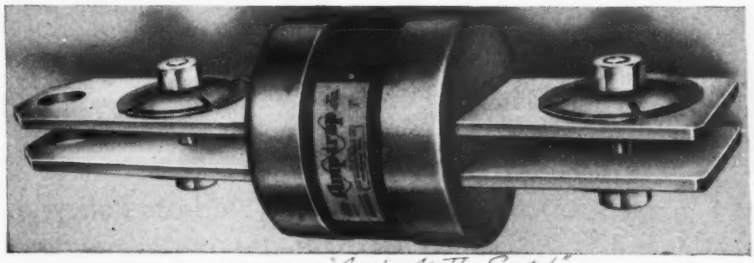
Amp-trap's small "let-through" current (low I^2t) gives positive protection to over current devices and contacts against high thermal or magnetic stress caused by super currents as high as 100,000 amperes R.M.S. at rated voltage. Amp-trap's operating characteristics limit stress on motor controllers, conductors, panel boards and load centers.

Amp-trap with PLUG-IN BUSWAY



Amp-trap's fast "chop-off" on high amperage short-circuit gives short-circuit protection to ordinary fuses and to isolate branch circuits without affecting feeder circuits or other branches supplied from the main busway. Actual tests on high short-circuit current have shown how Amp-trap amplifies plug-in busway momentary ratings by limiting magnetic and thermal stresses, and permits application of designs having limited withstanding ability on high powered installations.

Amp-trap is safe, efficient, economical short-circuit protection for electrical apparatus against large available short-circuit currents.



AMP-TRAP – *Awake At The Switch*

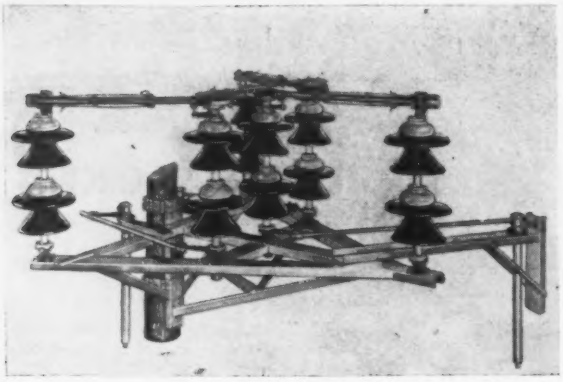
OUR 60 YEARS FROM EDISON TO ELECTRONICS

In Canada — Powerlite Devices, LTD.

THE CHASE-SHAWMUT CO.

370 MERRIMAC STREET • NEWBURYPORT, MASSACHUSETTS

NEW EQUIPMENT



Air Switch

A new series of 600-amp, 3-way, horn-gap, air switches ranging from 15 through 161 kv has been announced. Features claimed for the switches include:

1. High pressure contacts at both ends of the blade.
2. Beryllium copper at high pressure points.
3. Ball and roller bearings at friction points.
4. Neoprene seals in all bearing housings.
5. And advance design arcing horns.

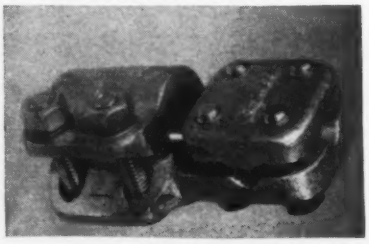
Clamps for conductor connections are the four bolt type. Overhead static wire can be provided when required. Pole bands for switch mounting are available.

Turner Electric Corp, 9510 St. Clair Ave, E. St. Louis, Ill.

Pole Setting Tool

A new patented tool for setting power poles up through energized lines has been announced. The tool, known as Pole Grip, enables one man to have complete control of the butt of the pole to safely guide the top of it up between power lines, it is claimed. The company reports that the tool not only eliminates one man, but is a safety tool as well.

Petersen Engineering Co, 460 Kifer Rd, Santa Clara, Calif.



Stud Connector

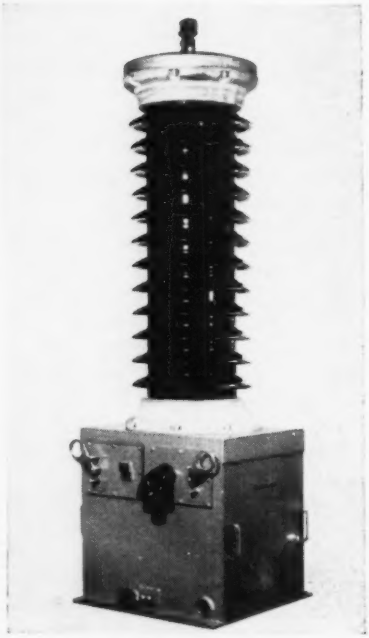
A new range-taking transformer stud connector, Type NDR, has been announced. It is designed to be used with 1⅛ - 12 threaded studs on high-voltage bushings of transformers rated 29.9 to 67 kv, 25 to 500 kva, single phase and three phase.

The connector accommodates a cable range from No. 6 solid to 4/0 stranded copper, using two different size grooves on one surface of the cap. Two perpendicular grooves of the same size in the body permit either horizontal or vertical take-off. Cable portion of the connector has tapped holes so that no nuts are required.

Burndy Engineering Co, Inc, Norwalk, Conn.

New Address Policy

Because of numerous requests from our readers for more complete addresses of companies announcing new products, Electrical World has changed its policy on listing addresses in this section. Hereafter, the complete address including the manufacturer's name, street number and name, city, and state will be published.



Coupling Unit

A new series of aperiodic line coupling units designed to connect several power line carrier transmitters to a transmission line has been announced. Units are essentially broad

(*Continued on page* 202)

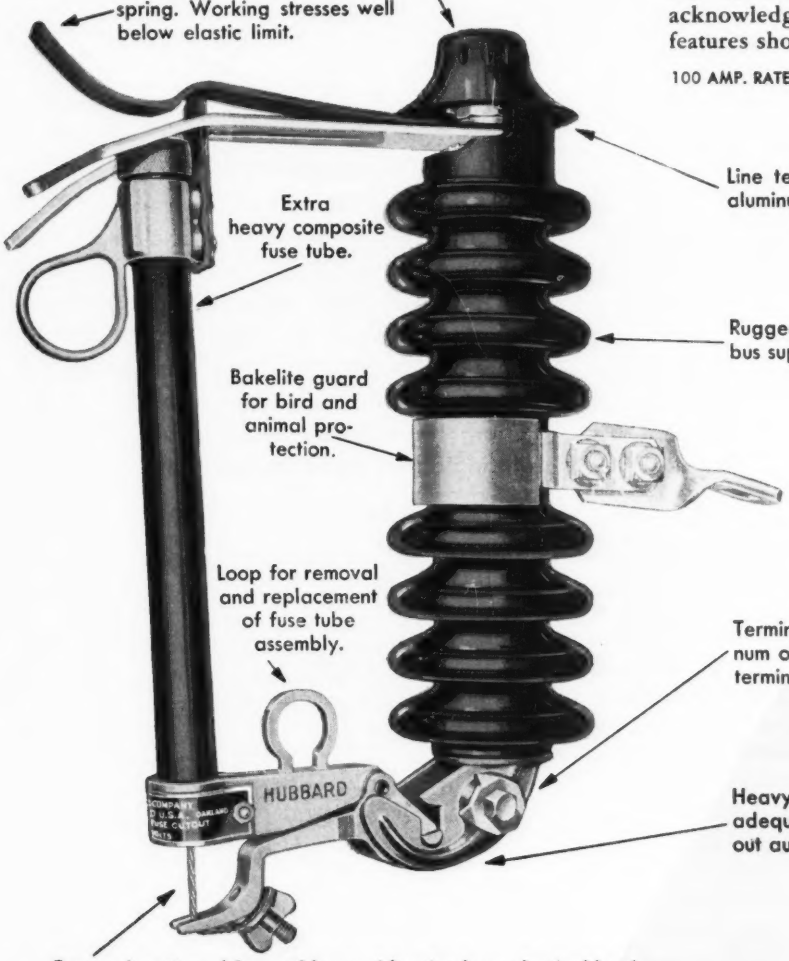
A New

Hubbard 7.5 KV Load Break Cutout

RUGGED • SIMPLE DEPENDABLE

A significant addition to the Hubbard line of electrical apparatus is made with the new No. 2531 load break cutout. Distribution loads may be switched with this simple design without any increase in cost in cutout investment. Simple re-fusing requires no tools. The early enthusiastic acceptance of No. 2531 is evidence that it supplies an acknowledged need. Note the distinctive features shown in the illustration.

100 AMP. RATED—2000 AMP. INTERRUPTING CAPACITY.



Terminal cap for effective bird and animal protection.

Extra long contact and action spring. Working stresses well below elastic limit.

Line terminal plated for use with either aluminum or copper conductor.

Extra heavy composite fuse tube.

Rugged one piece porcelain column with bus support type assembly.

Bakelite guard for bird and animal protection.

Loop for removal and replacement of fuse tube assembly.

Terminals plated for use with either aluminum or copper conductor. Alternate load terminals for right or left hand connection.

Heavy bronze safety lock hinge provides adequate current carrying capacity without auxiliary contacts.

Exposed section of fuse cable provides simple mechanical load break for links up to 50 Amperes without extra cost for cumbersome parts.

Straight mechanical withdrawal fuse cable of particular importance when currents of small magnitude are extinguished.

HUBBARD AND COMPANY

ESTABLISHED 1843

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the Load on Hubbard Hardware!"

new Thomas "Chip-Proof" insulator

A new corrugation design positively prevents chipping or breaking of inner petticoats. This protection is assured by eliminating the destructive bumping of caps or clamp fittings against the petticoats, yet gives complete interchangeability with all current designs as required by NEMA Standards. Only this new Thomas design (Patent applied for) can guarantee the virtual impossibility of damaging inner petticoats by rough handling during assembly or disassembly in the field.

● Naturally, we are excited. We believe our new petticoat design to be the answer to the insulator breakage problem, during construction, which has plagued the Industry for years. This design accomplishes positive elimination of insulator breakage during construction due to rough handling in coupling and uncoupling insulator units and in installing hardware fittings to the insulator strings.

Of course, the greatest benefit of this new design will be realized with the close-coupled units, but for all insulator spacings, our new design assures more ruggedness with resulting longer life . . . and at no additional cost to you!

The foregoing are bold statements. However, our most severe tests prove them and they are too important for you not to verify.

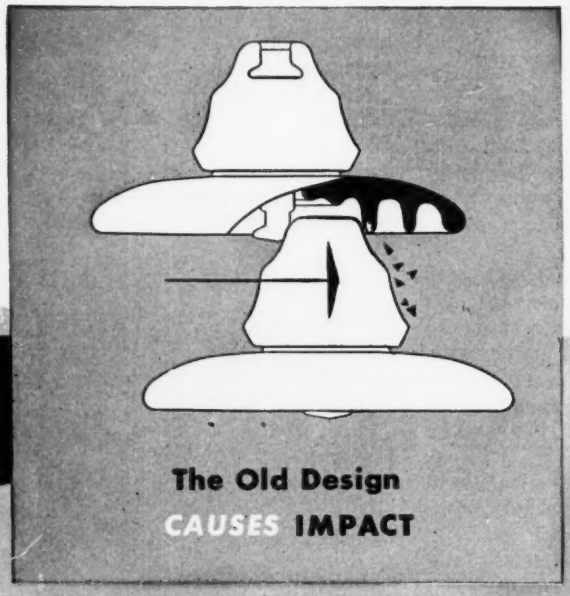
We suggest that you order TODAY, a standard crate of 6—No. 21239 THOMAS 1953-DESIGN SUSPENSION INSUALTORS. Test them thoroughly . . . and compare with other close-coupled designs.

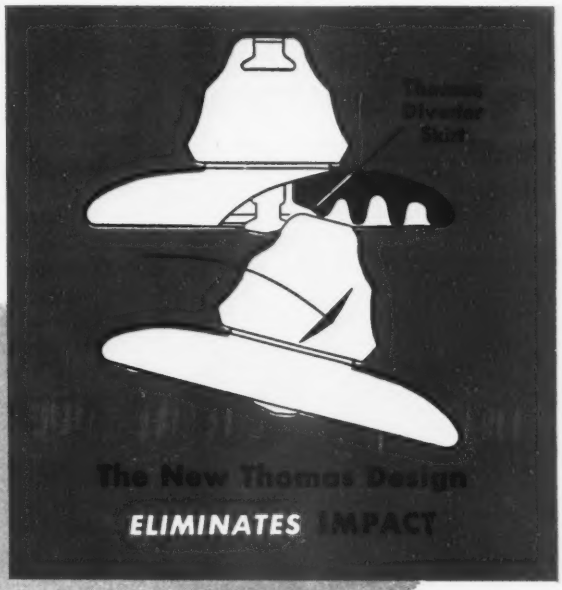
The R. Thomas and Sons Co.

1873 THOMAS INSULATORS our 80th year RELIABILITY 1953

LISBON, OHIO
NEW YORK CHICAGO

Sales Representatives: **C. G. Anderson,** *Chicago* **● E. B. Anderson Co.,** *Detroit* **● Conrad R. Bangh,** *Omaha* **● Ken H. Best,** *Seattle* **● Nellis B. Bronner, Jr.,** *Syracuse* **● R. E. Cunningham & Son,** *Los Angeles* **● W. H. Eddy Electric Products, Inc.,** *Phoenix* **● Engineer Sales Co.,** *St. Petersburg* **Electrical Distributors Co.,** *Philadelphia* **● Hamilton Associates,** *Denver* **● Geo. E. Honn Co.,** *San Francisco* **● Hugo Sales Co.,** *Minneapolis* **● J. P. Lane Co.,** *St. Louis* **● John G. Pettijohn Co.,** *Knoxville* **● H. E. Ransford Co.,** *Pittsburgh* **● J. F. Schaefer & Co.,** *Kansas City* **● R. J. Sullivan Co.,** *Boston* **Tafel Electric & Supply Co.,** *Louisville* **● Walter E. Thompson Co.,** *Birmingham* **● Triangle Electric Supply Co.,** *El Paso* **● United Electric Supply Co.,** *Salt Lake City* **● Williamson Sales Co.,** *Shreveport, Amarillo, Corpus Christi, Dallas, Houston, New Orleans, Pine Bluff* **● Representatives in other principal cities**





eliminate *Impact*

and you eliminate breakage

For many years, The R. Thomas and Sons Company has been well aware of the insulator breakage problem during construction. But none of us imagined the solution to be so simple and yet so effective.

Examine carefully the two drawings above. Note that with the OLD design (illustrated at the left) when the lower insulator is uncoupled, it can easily be SLAMMED directly in a straight line against the innermost petticoat. Obviously, this action results in a chipping or breaking IMPACT.

Now note how the THOMAS DIVERTER skirt (illustrated at the right above) eliminates impact. This DIVERTER skirt (Patent applied for) is simply a heavy corrugation designed with a contour that *diverts* the lower insulator or fittings away from any petticoats.

No matter how roughly the insulators are handled, when the cap is pulled off the ball pin, it will first strike the DIVERTER which it cannot break. This glancing blow will deflect any destructive IMPACT from the lighter petticoats. Simple . . . but EFFECTIVE.

All standard Thomas 10-inch suspension insulators now have this feature . . . at no extra cost.

Specify **THOMAS INSULATORS—THE BEST BY LINE TEST**

The R. Thomas and Sons Company is a manufacturer and designer of all types of porcelain insulators . . . pin-type, switch, suspension, spools, guy-strain, bushings and special high-voltage porcelain. In addition, Thomas supplies associated line hardware, clamps, fittings, and so on.

Utilities Have Specified
SILENT HOIST Equipment
• Since 1918 •

KRANE KAR **Swing-Boom Mobile Crane: for materials-handling . . . lifting, transporting, positioning, gasoline or Diesel, 1½, 2½, 5 and 10 ton capacities, 9 to 37 ft. booms (or telescopic booms), solid or pneumatic tires. Self-stabilizing without jacks or outriggers; unobstructed vision; fast, flexible, safe, easy to operate.**

WINCHES: Capstans; Single and Double Drum, Jaw Clutch, Keyed and Friction Clutch Winches. 2,000 to 50,000 lb. Capacities.

SWING-BOOM CRANES: Truck: Motor Power Operated; high capacity; takes up only a small space. For handling transformers, cable reels, lamp posts, trees, poles, manhole castings, etc. 9 to 31 ft. booms; one to 10 ton capacities.

TOWERS: 2 or 3 section type and Pantograph types, with plain, revolving or racking platforms.

TRIPOD POLE DERRICKS: for 35 ft., 45 ft., and 60 ft. Poles; single piece or telescopic side legs; removable cast steel fittings.

USERS: AT&T; N. Y. Tel. Co.; T.V.A.; Consolidated Edison Co.; W.U.; Municipalities throughout America.

WRITE FOR CATALOGS:
No. 79—KRANE KAR No. 70—Truck Equipment

THE ORIGINAL SWING BOOM MOBILE CRANE WITH FRONT-WHEEL DRIVE AND REAR-WHEEL STEER
2½, 5, AND 10 TON CAPACITIES
KRANE KAR
TRADE MARK REGISTERED
SILENT HOIST & CRANE CO.
862 63rd ST., BROOKLYN 20, NEW YORK

Coupling Unit

(*Continued from page* 199)

band filters capable of passing signals in the carrier frequency band from 50 to 200 kc. They are suitable for either pedestal or suspension mounting in standard installation classes from 46 to 345 kv.

Capacitance of units is said to be very high. For example, 161 and 345-kv models are rated at 0.0043 and 0.002 microfarads, respectively. Electrical characteristics of the capacitor are unaffected by mechanical strain because of a newly designed oil seal.

Space is provided within the base to house the companion potential device and associated adjustment unit. Adjustments are made on the "dead-front" panel which separates the front and rear compartments. The grounding switch is of heavy construction with positive detents in both directions. Switch position is clearly indicated.

Motorola, Inc, 4545 W. Augusta Blvd, Chicago 51, Ill.

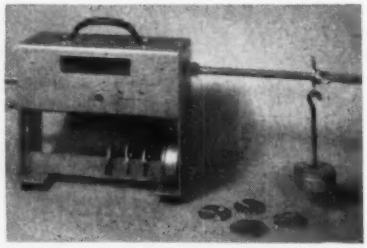
Non-Magnetic Relay

A new relay, called Capaswitch, which is an ultra-sensitive non-magnetic relay, has been announced. It reportedly uses an electrostrictive capacitive element (0.05 microfarad) requiring only 0.5 milliwatt-seconds of operating power at 150 v dc to close the contacts, and less than 0.1 milliwatts to hold them closed.

The electrostatic element may be used to store minute amounts of energy from a low-energy source until enough is accumulated to operate the relay. To open the contacts the voltage is removed and the element is discharged through circuit elements.

Input resistance of the electrostatic element is about 100 megohms. Normal closing delay is about 10 milliseconds. The relay is said to withstand voltage variations as much as 300% overvoltage without damage. Contacts are single pole, double throw, rated at 1 amp, 110 v ac, none-inductive load.

Mullenbach Electrical Manufacturing Co, 2300 E. 27th St, Los Angeles, Calif.



Pressure Calibrator

A pneumatic calibrator for testing and calibrating pressure instruments, which operate between 20 in. of water and 25 psi, has been announced. The calibrator operates from a 35-psi air source and may be adjusted accurately to produce any pre-determined pressure by adding or removing calibrated weights from a weightbeam.

The instrument is portable and can be used, in many cases, to check instruments without removing them from their mounting.

Republic Flow Meters Co, 2242 Diversey Parkway, Chicago 47, Ill.

Starter and Switch

A new line of ac combination starters with disconnect switches, designed in accordance with JIC standards, has been announced. They are intended for use wherever non-reversing magnetic across-the-line starters

DOW

GOING UP EVERY DAY... PENTA TREATED SOUTHERN PINE POLES

Clean, modern wood preservative controls decay and termites, cuts repair costs and gives long life to all wood poles

The Dow Chemical Company
Dept. PE 3-2B12, Midland, Michigan.

☐ Please send me free booklet, "Pointers on PENTA."
☐ Send me list of PENTA treating plants.

I am interested in PENTA for_____

Name_____

Title_____

Company_____

Address_____

City_____ State_____

Southern Pine utility poles, pressure-treated with *clean* PENTA*, are giving top performance in many sections of the country. Year after year, under all weather conditions, in all types of soil, PENTA keeps these pine poles well protected against decay and termites.

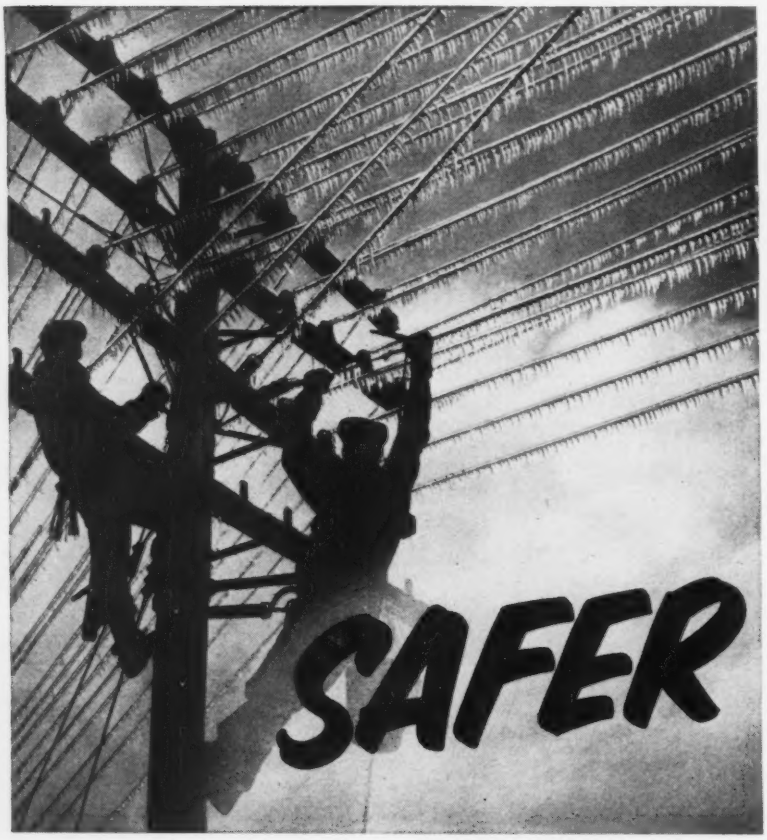
You can count on low repair and replacement costs when you specify PENTA protection. Just as important, PENTA provides that necessary "extra"—*cleanliness*, important for settings in residential areas.

Specify *clean* PENTA for all your wood construction. Over 60 pole suppliers now treat with PENTA. Ask your regular supplier to give you a quotation on PENTA-treated poles and crossarms. THE DOW CHEMICAL COMPANY, Midland, Michigan.

*PENTAchlorophenol.

you can depend on DOW CHEMICALS

DOW



A veteran lineman was asked: "What precautions do you take before climbing a pole to make sure that it is safe?" His reply: "First we make sure it's a Koppers Pole, then we don't worry."

on dependable Koppers Poles

• It's a nasty job, at best, to work on lines that are crusted with ice. And linemen don't want the additional danger of working on spongy poles that have been weakened by shell rot.

When the poles are Koppers, linemen are safer. They *feel* safer, too, because they know their gaffs will get a good, solid bite on sound wood.

Koppers Poles, for their full length, are pressure-creosoted against decay, weathering and termite attack. They *stay* sound and strong through the years.

Many strategically located Koppers treating plants assure prompt, dependable service.

For dependable poles, backed by a dependable company, specify Koppers. Write to us for prices or further information.

KOPPERS COMPANY, INC.
Wood Preserving Division • Pittsburgh 19, Pennsylvania

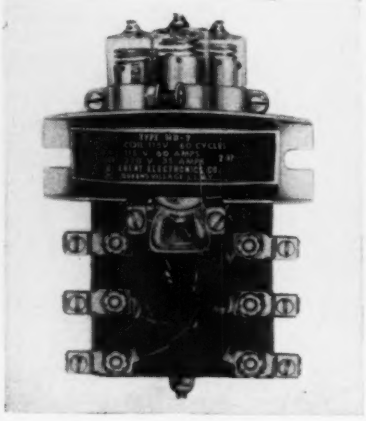
KOPPERS PRESSURE-CREOSOTED WOOD

with disconnect means at the starter location are specified.

Components include a magnetic full voltage starter, a dual voltage control transformer, and pilot circuit fuse in combination with either a fusible or non-fusible disconnect switch. Parts are fastened to a removable steel panel mounted in a NEMA Type XII enclosure.

Outstanding features are said to be compact construction, quick make and break disconnect switch mechanically interlocked with cover, and front of board wiring. Maximum rating available is NEMA Size 3, 50 hp, 440 v, 3 phase, 60 cps.

Ward Leonard Electric Co, 115 Mac-Questen Pkwy, Mount Vernon, N. Y.



Relay

A new three-tube relay, called HD-7, has been announced. It features mercury-to-mercury contacts and is said to be silent, chatter free, hermetically sealed, explosion proof, and require no maintenance. The relay is available both for normally open and normally closed applications.

Each of the three tubes can control up to 60 amp at 115 v ac and 35 amp at 230 v ac. Dc control capability per tube is 12 amp at 115 v. Coils are obtainable for a variety of control voltages.

Ebert Electronics Co, 212-26 Jamaica Ave, Queens Village 28, L. I., N. Y.

Emergency Light

A redesigned line of 6-v emergency lighting equipment, which is said to feature increased efficiency and service life, has been announced.

makes CORE and STRAND Share the Load

Once the two-bolt clamp is tightened on the Reliable No. 420 Snub Deadend, both the steel core and the aluminum strand carry their full share of the load. There is no slippage that throws all the load on the aluminum strand. The two-bolt clamp is simple to tighten and subjects the ACSR to a minimum of vibration fatigue. This deadend is approved for use without armor tape. No. 420 ACSR Snub Deadend has the added advantage of being extremely light in weight. Many thousands of these deadends are giving unobtrusive yet unfailing service.

Reliable **ELECTRIC COMPANY**

3143 CARROLL AVENUE
CHICAGO 12, ILLINOIS

OVER 45 YEARS OF SERVICE TO THE UTILITIES

POWER-LINE CONNECTORS and CONSTRUCTION SPECIALTIES

be sure of

UNIFORMITY. . . use

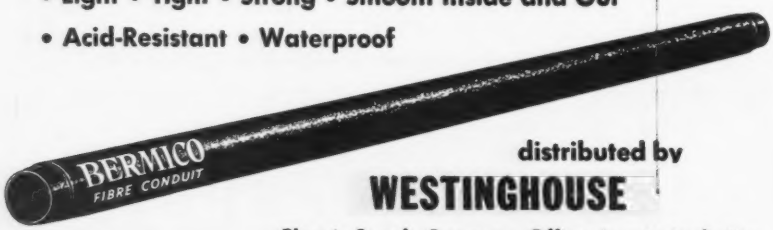
BERMICO® FIBRE CONDUIT

Uniform wall thickness • *Uniform* diameter of bore • *Uniform* impregnation • *Uniform* quality of fibre.

Automatic forming and processing . . . close controls over the drying process . . . machining of taper and length . . . four rigid factory inspections—these are the things that guarantee Bermico's uniformity of dimensions, specifications and quality.

For surest cable protection, be sure to specify Bermico Fibre Conduit. Made by Brown Company from sturdy wood fibre, impregnated with pitch, it is—

• Light • Tight • Strong • Smooth Inside and Out
• Acid-Resistant • Waterproof



distributed by
WESTINGHOUSE
Electric Supply Company. Offices in principal cities

BROWN QUALITY **COMPANY, Berlin, New Hampshire**
CORPORATION, La Tuque, Quebec

SOLKA & CELLATE PULPS • SOLKA-FLOC • NIBROC PAPERS • NIBROC TOWELS • NIBROC KOWTOWLS
NIBROC TOILET TISSUE • BERMICO SEWER PIPE, CONDUIT & CORES • ONCO INSOLES • CHEMICALS

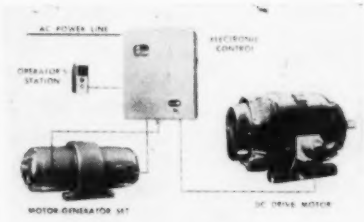
Units are available with one or two 25-w sealed beam lamps that are adjustable to provide light in any direction.

Lamps are connected to a battery through a toggle switch and relay contacts. The battery is charged by a built-in trickle charger that is connected to a normal ac source. When

the unit is not connected to the source, the relay contacts in the lamp circuit are closed and lamps can be energized by closing the toggle switch.

Another toggle switch on the front panel selects the charge rate, which is indicated by a red light that glows when switch is set for fast charging. A pushbutton switch and neon lamp provide a check on the unit's readiness for service.

Electric Storage Battery Co, P. O. 8109, Philadelphia 1, Pa.



Variable Speed Drives

A new line of electronically-controlled variable speed drives ranging from ⅛ to 10 hp has been announced. They feature smooth starting, fast stopping, a wide range of operating speeds, constant torque over the speed

range, and good speed regulation. In operation, power is converted by a motor-generator set and by rectifier tubes to supply a dc shunt wound motor.

Type GV drives have basic speeds of 2,400, 1,750, and 1,150 rpm. Speeds are adjustable down to 1/6 of basic speed for continuous duty, 50C, and to 1/10 of basic speed for intermittent duty.

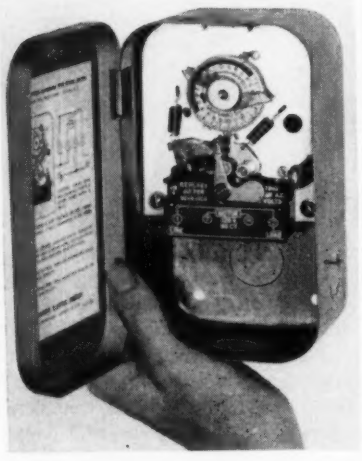
Master Electric Co, 126-46 Davis Ave, Dayton, Ohio

Generators

A new group of 1,800-rpm emergency power generators in ratings of 2 to 15 kw have been announced. They are designed to be belt driven from any speed governed engine. Generators from 2 to 5 kw have a rotating armature and output voltage of 115 v, 60 cps, single phase. Two models in this range have voltage outputs of 115/230 v, 60 cps, single phase, four wire.

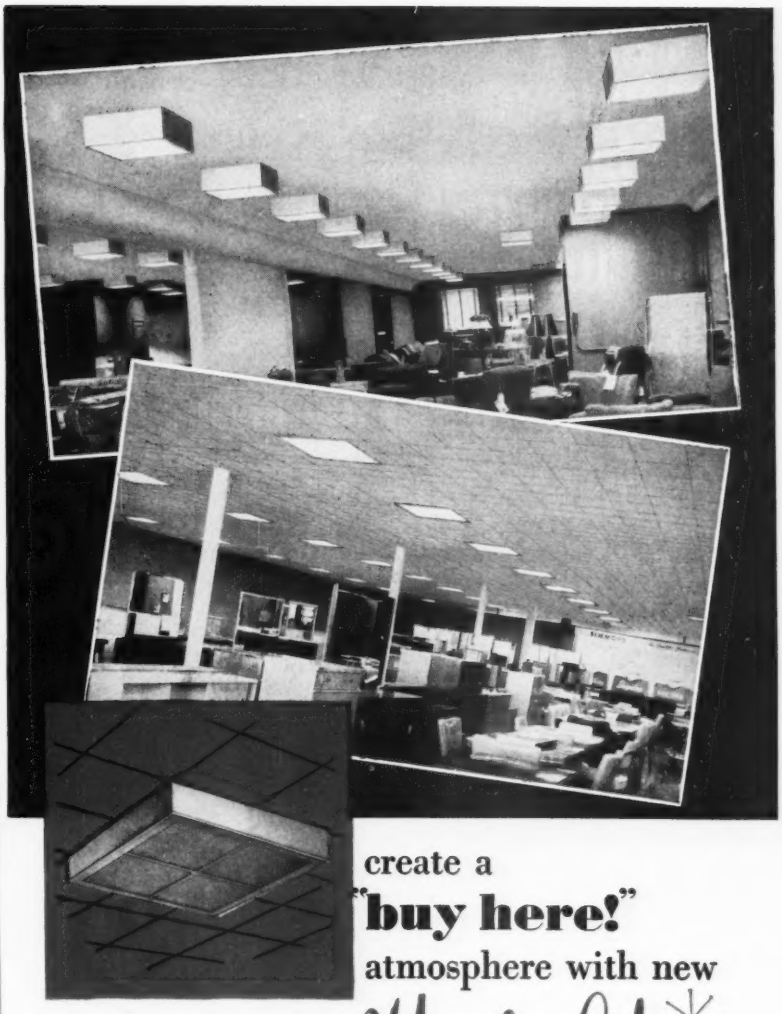
From 5 to 15 kw, generators have rotating fields and are available in either single phase or three phase, 115/230 or 120/208 v, 60 cps, four wire. A standard pulley, a panel complete with a voltmeter and rheostat, and approved transfer switches can be supplied with all models.

Katolight Corp, 624 N. Front St, Mankato, Minn.



Time Switch

A new 30-amp, single-pole, single-throw switch that employs a slow-speed hysteresis motor and synchro-



create a
"buy here!"
atmosphere with new

Guth Magic-lite*
with GRATELITE** Louver-Diffuser

the magic combination of architectural beauty and sales-building lighting for contemporary store interiors.

GUTH MAGIC-LITE is well-shielded by a GRATELITE Louver-Diffuser. It transforms the direct light into softly flattering illumination, essential for good merchandising.

LOW ORIGINAL COST—LOW UPKEEP COST

Uses least expensive lamps—GrateLite Louvers are cleaned in 2 minutes.

VERSATILE

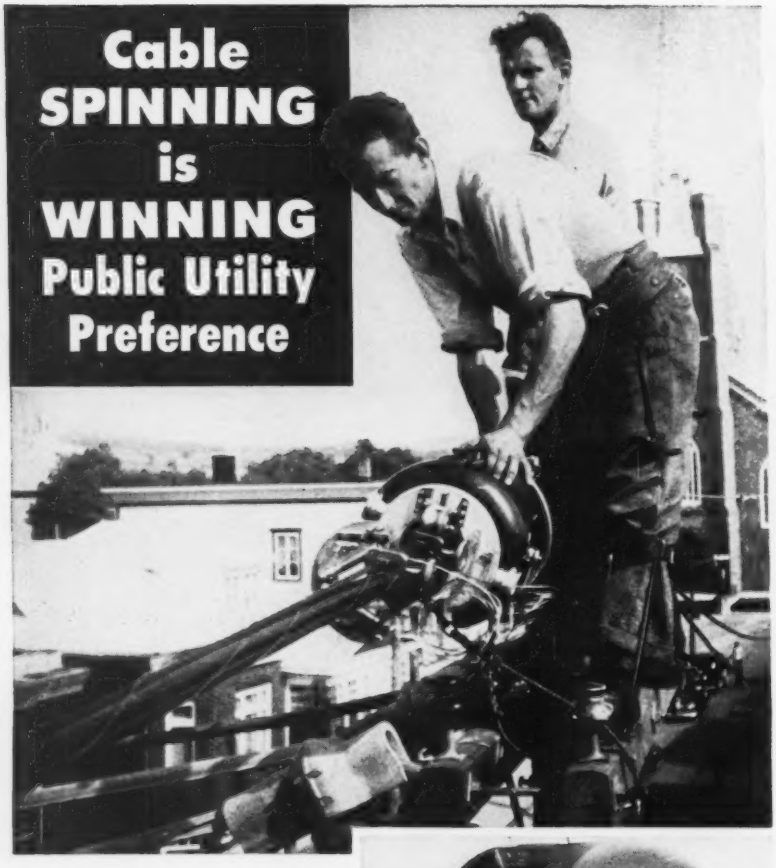
Mount singly or in patterns. Recess or surface. 24" or 12" square sizes.

*Trademark
**U.S. & Can. Pats. Pend.
Trademark Registered

May we send you our new Magic-lite Catalog 901-H?

THE EDWIN F. GUTH CO. ST. LOUIS 3, MO.
Leaders in Lighting since 1902

Cable SPINNING is WINNING Public Utility Preference



More and more public utilities every day are turning to the Neale Model "K" Cable Spinner—specially designed for economical and efficient power line use. And here are some of the benefits . . .

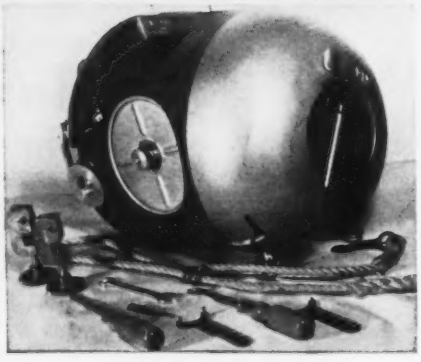
It actually costs much less to install spun cable than pre-assembled cable. And, of course, spun cable saves valuable space in open-wire construction in congested areas.

Light weight single conductor cables may be spun in lengths three times as long as pre-assembled cables . . . to save splices and installation labor.

Spinning reduces cable inventories, because 1/c, 2/c and 3/c cables can be spun in the field as required.

Cable spinning provides a big margin of extra protection against storm damage . . . and has proved invaluable in emergencies of all kinds.

You're invited to send for full technical details on the Neale Model "K". Just drop a line to Cable Spinning, Topeka. *Neale Spinning Wires available in seven different types and sizes.*



Main illustration shows spinning of cable in Canada. Inset is close-up of the Neale Model "K" Cable Spinner, with accessory tools. Model "K" spins a single cable or three 2" cables into a compact triangular pattern. Strand lies in groove formed by two top cables.

HOW IT WORKS. Drum rotates when its two friction drive wheels respond to pulling of wire. Drum revolves once when 13" of wire is pulled — regardless of condition of strand. Drum carries two spools of wire, spaced to spiral 6½" apart for ample cable support. Magnesium castings used wherever possible for lightness and strength. Weight is only 36 pounds. Length 18½", 12" diameter, 4¾" wire exit.

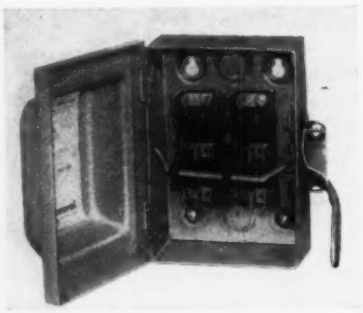
THE WORLD IS SPINNING—TOO!
PHONE 2-7234

Cable Spinning Equipment Co.

3100 TOPEKA AVE. TOPEKA, KANSAS

nous timing mechanism has been announced. Heavy silver contacts, insulating safety shield, four levers for two "on" and two "off" operations, and easily manipulated trippers are features.

Ample space for wiring, four multiple knockouts, and a keyhole mounting slot permit fast installation. The entire mechanism is enclosed in a 4¼ x 7¼ x 3⅛-in. gray steel case. **Sangamo Electric Co, 11th & Converse, Springfield, Ill.**



Safety Switch

A new 30-amp enclosed safety switch, Type A, which assures smooth action and long life, has been announced. Features of the switch include special bronze alloy fuse clips with reinforcing steel springs, break-jaw design assuring correct blade alignment, and compact enclosure with ample wiring room.

For simple, fast maintenance and inspection, the interlock cover may be defeated to open the door with switch closed. The defeating mechanism also permits switch to be closed when door is open.

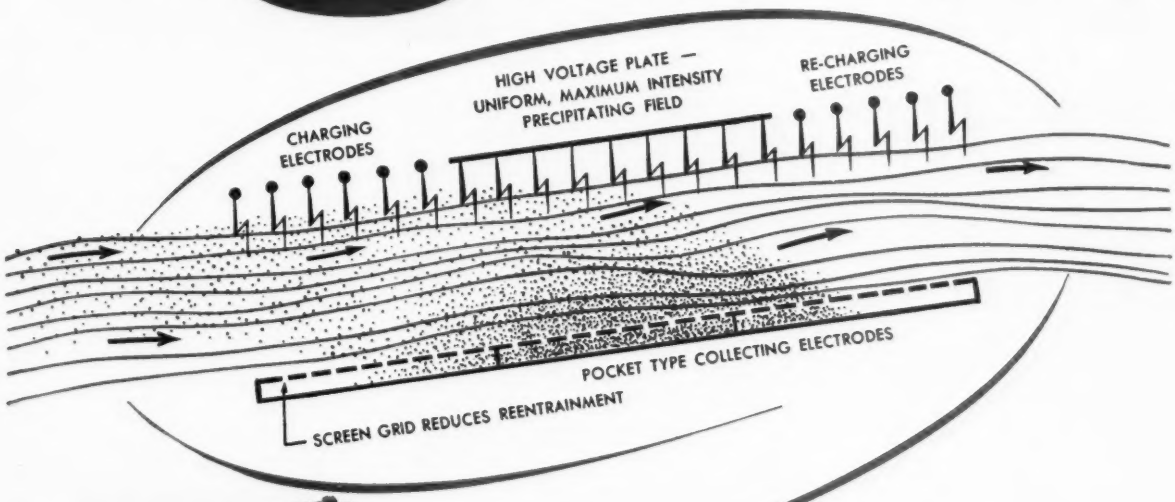
General Switch Corp, 45 Roebling St, Brooklyn 11, N. Y.

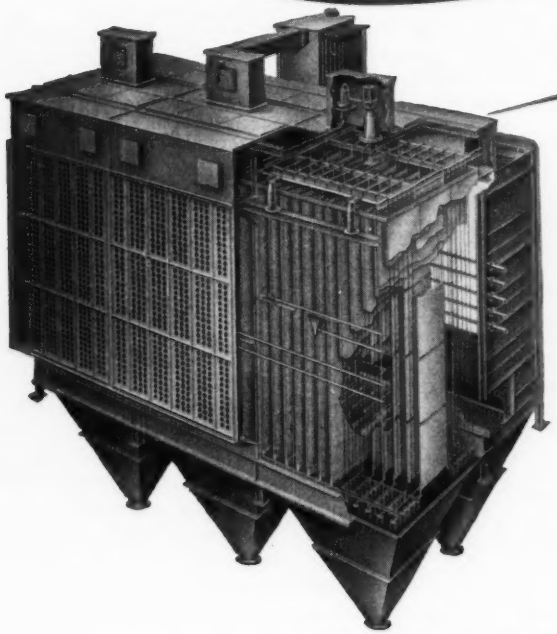
Tube Checker

A new tube checker, claimed to provide high accuracy and time-saving facility in testing all tube types, has been announced. The Model 981 Type 2 provides for measurement of proportional mutual conductances, emission characteristics of rectifiers and diodes, and firing potential limits of voltage regulators and low power thyratrons.

The checker measures leakage resistance as high as 5 megohms between tube elements and transconductances up to 24,000 micromhos. Multiple

The reasons for High Efficiency with AEROTEC Electrical Precipitators


HIGH VOLTAGE PLATE — UNIFORM, MAXIMUM INTENSITY PRECIPITATING FIELD
RE-CHARGING ELECTRODES
CHARGING ELECTRODES
POCKET TYPE COLLECTING ELECTRODES
SCREEN GRID REDUCES REENTRAINMENT



Exclusive design of the charging and collecting electrodes is the principal reason why Aerotec Electrical Precipitators assure higher precipitation efficiency and retention of dust particles.

In the first zone of the unit, six high-voltage wires charge the dust. A flat high-voltage plate provides an area of maximum field intensity in the second zone, and forces the charged particles toward the collecting electrode. This high-voltage plate reduces power input, as it is not a discharge element, and results in a maximum, *uniform* precipitating force.

The collecting electrodes are of a pocket-type design. They provide a recessed, comparatively quiet section for retaining the dust. Aerotec collecting electrodes are composed of a flat plate, vertical baffles, and a screen grid that acts both as a mechanical and electrical barrier.

Particles or agglomerates are not exposed to the direct scouring action of the gas stream and are therefore less likely to be reentrained.

The pocket-type electrode further reduces reentrainment as the vertical baffles and screens form channels through which dust falls to storage hoppers. The Aerotec design utilizes continuous short interval rapping. Heavy build-up on the collecting electrodes is thus eliminated, resulting in a consistently clean stack.

The Thermix Corporation, Project Engineers for the Aerotec Corporation, will be glad to help you in the solution of your dust problem. Why not contact them for further details on this highly efficient method.

Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.

(Offices in 38 Principal Cities)

Canadian Affiliates: T. C. CHOWN, Ltd., Montreal 25, Quebec; Toronto 5, Ontario

Manufacturers

THE AEROTEC CORPORATION

GREENWICH, CONN.

ELECTRONIC TELEPHONE LICKS NOISE!

MODEL NO. 100

*The GAI-PHONE

MAKES COMMUNICATION POSSIBLE
IN EXTREMELY NOISY AREAS.

- NO BOOTH REQUIRED.
- SURPRISINGLY LOW COST.
- PROVED PERFORMANCE.
- RUGGED LONG-LIFE CONSTRUCTION.
- OPERATES AS CONVENTIONAL TELEPHONE.
- EASILY INSTALLED IN EXISTING TELEPHONE CIRCUITS.

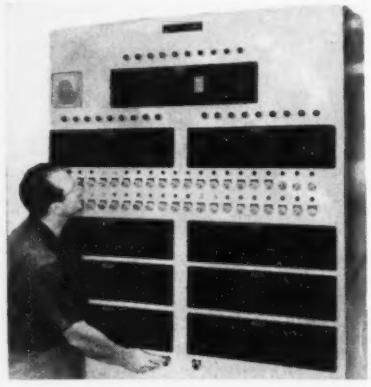
GAI-TRONICS CORPORATION
A SUBSIDIARY OF GILBERT ASSOCIATES, INC., ENGINEERS AND CONSULTANTS
READING, PA.

FREE BOOKLET
WRITE · GAI-TRONICS CORPORATION DEPT. P, READING, PENNA.

switching permits any combination of tube connections to be made. Only one socket is used for each tube base; sockets are provided for all conventional type tube bases.

The checker provides 19 filament voltage settings from 0.65 to 115 v and 5 plate voltages from 20 to 177 v. Signal voltages of 3.2/1.6/0.8/0.4 v are provided at a frequency of 5 kc. For testing voltage regulator tubes a rectifier supply furnishes 200 v dc up to 65 ma.

Weston Electrical Instrument Corp, 614 Frelinghuysen Ave, Newark 5, N. J.

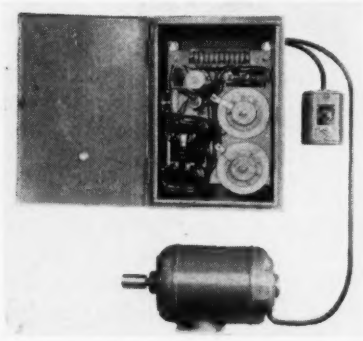


Annunciator

A new annunciator system that pinpoints the cause of trouble by indicating the first variable to go off-normal has been announced. This is accomplished either by automatic lock-out of subsequent signals, or by causing the first signal to be red and subsequent signals white. A push-button reset feature is available that causes the sequence indication to start over again.

Alarm signals are grouped for sequential lock-out and any number of inter-related groups may be formed or interchanged as desired. Contacts, relays, and other moving parts are

within hermetically sealed plug-in units. The entire system is suitable for Class 1, Division 2 locations.
Panalarm Products, Inc, 6312 N. Broadway, Chicago 40, Ill.



Motor Drive

A new magnetic amplifier motor drive that rectifies 115-v, 60-cps supply to control a dc motor has been announced. The packaged unit consists of a main control panel, a control station, and a motor. It provides a speed range of 10:1 and is available with motors rated from 1/40 to ½ hp.

The device employs a full-wave, self-saturating, magnetic amplifier unit. Included also in the circuit are a variable armature supply, a field supply, a control circuit, and short-circuit and overload protection. Optional features include jogging, dynamic braking and reversing.
Clark Controller Co, 1146 East 152nd St, Cleveland 10, Ohio

Protective Coating

A new protective coating, formula 67, that is said to be acid proof, rust resistant, water proof, alkali proof, and grease proof, has been announced. It is recommended for metal, wood, glass, brick, unglazed tile, cement, concrete and other masonry.

The coating is easily applied with brush or spray, needs no primer or base coat on properly cleaned surfaces, and needs no after coat, it is claimed. Drying time is about 20 min. Colors are said to be permanent and will not chalk or fade from effects of weather. Coating is available in 1, 5, and 55-gal quantities.
Babbitt Steam Specialty Co, Babbitt Square, New Bedford, Mass.

★ **SUBOX PROTECTS . . .**
maximum resistance to rust, weather, steam, moisture, condensation, oils, and cleaners.

★ **SUBOX DECORATES . . .**
metallic finishes right in the *first coat* — no overcoat is necessary. One Subox color for all structural steel creates harmony.

★ **SUBOX SPEEDS WORK . . .**
self-priming means fewer coats. A single coat for interiors and a double coat outdoors gives adequate protection.

★ **SUBOX REQUIRES NO UNDERCOAT . . .**
durable lead base in Subox paints allows repainting again with the same material or acts as enamel undercoat.

★ **SUBOX CUTS COSTS . . .**
no priming touching up is necessary in interior shop-coated steel before applying Subox paints.

SPECIFY SUBOX . . .
time-tested for more than 25 years

***Write today for your free copy of informative article on how to cut painting costs with "Plan Painting."**

Subox Inc.
3 Fairmount Plant Hackensack, N. J.

2,4,5-T ACID and ESTERS

off-season brush-off

Mid-winter and early spring weeks are effective times for clearing off brush and weeds from right-of-ways and other areas with 2,4,5-T spraying.

Absence of foliage enables work gangs to get through the growth faster and more thoroughly . . . and free from trouble with insects and snakes. The off growing season removes the problems of damage to adjacent crops or valued plantings. And since 2,4,5-T can be applied in oil solution, low temperatures do not present the usual difficulties in spraying.

Effective procedure is to spray by hand, with knapsack sprayer employing a single-nozzle boom. A hose line from a supply truck is advantageously used when terrain and extent of application permit. A solution of ⅛ pound of 2,4,5-T (acid equivalent) in 2½ to 4 gallons of diesel or fuel oil applied to the base of the trunk gives good results.

Your dealer will gladly furnish additional data on mid-winter spraying. Or we will welcome your inquiry about 2,4,5-T formulations and their usage.

ETHYL CORPORATION
Chemicals for industry & agriculture

100 PARK AVENUE, NEW YORK 17, N.Y.

ATLANTA, BATON ROUGE, CHICAGO, DALLAS, DAYTON, DENVER, DETROIT, HOUSTON, KANSAS CITY, LOS ANGELES, NEW ORLEANS, PHILADELPHIA, PITTSBURGH, SALT LAKE CITY, SAN FRANCISCO, SEATTLE, TULSA, MEXICO CITY AND (ETHYL ANTIKNOCK, LTD.) TORONTO.

ETHYL CHEMICALS ETHYL CORPORATION

LETTERS TO THE EDITOR

Accidents Do Happen

To the Editor:

Reading the item "Accidents Don't Happen," Section 20 of the safety manual produced by American Gas & Electric Service Corp (EW, Nov. 23, p. 17), brings up a question. Paragraph "c" reads:

"Making safety devices inoperative such as removing guards from machines, using fuses, blocking safety valves."

Just why "using fuses" is an unsafe act is rather difficult to explain, since it is generally considered that a fuse is the safest protective device that can be used.

Is this a misprint? If not, would you please let me know the reasons underlying this statement?

William S. Edsall, Chairman
Fuse Section Publicity Committee
National Electrical Manufacturers Association

• In answer to the above, Allen M. Perry of AG&E's public relations department said: "I wish to point out that the important word "oversize" is ahead of fuses in Section G-20, paragraph "c", but was omitted in EW's reset version . . ."

Overall Rate View Needed

To the Editor

Regarding your editorial on "Management at the Crossroads" in the Nov. 2 issue, in which you point out that the Federal Power Commission set its own rate schedule in the United Fuel Gas decision and overruled practically every opinion of the company's managerial policy, it seems to me that you might well look at the other side of this picture as it affects the Public Service Commission's operations in New York State.

Here the PSC apparently never exercises its authority in the matter of rate schedules unless the record indicates that the company will make an excessive overall profit. Recently, in the Consolidated Edison Co's gas case, the company proposed a rate schedule for gas that involved the treatment of mixed gas and of straight natural gas on a comparable Btu basis. The commission refused to require the company to set up a rate for straight natural gas as compared with the rate for mixed gas even though it was shown that the cost of service for the straight natural gas was different from that of the mixed gas.

When a commission refuses to review or exercise its authority with regard to rate schedules of the same company which may be at great variance with the cost of service involved simply because the company is not making an excessive profit, they are not serving the public as it thinks the public should be served.

Failure to rationalize between a straight natural gas rate and a mixed gas rate under the excuse that the company's revenue would not be high enough under the proposed rates, permits the company to establish differentials in its schedules which are unduly discriminatory between customers who must take straight natural gas and those who take mixed gas.

The failure of the commission to examine into the different rate schedules and to adjust them for the proper and reasonably different uses invites the criticism of the public and makes the action of the FPC to which you refer more likely to be called for in the future, if a more rational approach is not adapted.

Carroll H. Shaw
Consulting engineer
New York City

Year-End Report

Electrical World is going to offer a year-end dividend in its Dec. 28 issue. It will come in the form of a 19-page report on significant advances made in the electric industry during the past year; plus a forecast of what may likely happen in all areas of electrical interest in 1954. In addition to areas of technical interest the special feature will consider national power policy, regional power trends, nuclear developments, and the foreign picture.

Slight Miscalculation

To the Editor:

As a manufacturer of one kind of the equipment used in it we are pleased with the articles in Electrical World, Nov. 2, 1953 on electrical house heating. However, there is a discrepancy in the formula for electric heating calculations.

The F. H. A. Formula of $F = \frac{H \times D}{Td \times 200}$ should be used only for glass panel heating systems. This formula was first developed and used in National Bureau of Standards tests conducted on Continental Radiant Glass Heating equipment. Prior to these tests, the factor "200" in the denominator was 170, therefore, all other direct resistance electric heaters would still use this factor of 170, whereas the glass heater units use the factor of 200. This increase is due to many reasons, but probably the most prominent is radiant heating effect.

In the table of "Comparison of Calculations", there are about four homes which do not fit the F.H.A. formula closely. These could be due to the fact that they do not use glass heating systems and should have used the "170" figure, in their estimated kwhr consumption.

William Anderson
Engineering Department
Continental Radiant Glass Heating Corp
New York, New York

Needed: Better Wiring

To the Editor:

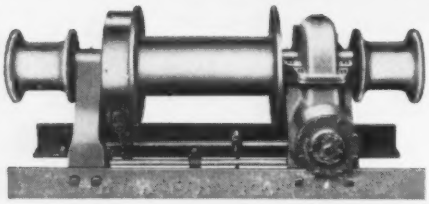
I read your article in the Nov. 9 issue concerning "Appliance Sales vs. Inadequate Wiring." I believe the article clearly indicated the existence of inadequate wiring, the need for doing something about it, and the fact that the lead must be taken by utilities.

I believe our plan for financing residential wiring is one tangible way to overcome the obstacle you mentioned. From the inquiries we are receiving from various sections of the country, I am led to believe that other utilities may also take steps in this direction.

The acceptance of our plan locally to date has been very satisfactory and we believe it will do much to correct the inadequate wiring and assist in the sale of major appliances and the kwhr necessary to operate them.

Frank E. Wiatt
Assistant Manager
Electric Sales Department
Cincinnati Gas & Electric Co

TULSA* WINCHES



The Model 23 Tulsa Winch is installed on the truck below. There are 27 other models in capacities from 6,500 to 80,000 lbs. for all makes and models of trucks and crawler tractors.

FOR HAULING...

Loading and unloading 3-ton cable reels is a simple task for this California trucking contractor. Working for a West Coast public utility, the driver easily, quickly and safely handles these reels of expensive copper cable. His Model 23 Tulsa Winch does the entire job.

Tulsa* Winch
TULSA, OKLAHOMA
DIVISION OF VICKERS Inc.

*Reg. U. S. Pat. Off.

WHAT THEY'RE SAYING

At Industry Meetings

Must Keep 'em Happy Down on the Farm

N. BERNARD GUSSETT, president of Iowa Power & Light Co, at third annual Power Supplier Conference of the 4-H Farm and Home Electric Program, Chicago.

Failure to convince the young farm men and women of today that they should select farming as their life work could contribute substantially to our defeat in the coming trade war for economic survival.

It is our job as power suppliers to continue to study and to help solve the problems of rural electrification in order that we can do our bit toward convincing young people that farming does offer a career whose rewards are at least as great and whose way of life is much superior to that of the city dweller.

It seems to me that nowhere else in our economy is there a plan of living which offers so great a promise as the farm of tomorrow, that nowhere else is there so ideal a combination of the opportunity for productive work, physical and mental, tied-in with adequate rewards.

Industry Still Offers Huge Electrical Potential

PHILIP A. FLEGER, chairman of the board, Duquesne Light Co, before the Pittsburgh Real Estate Board

Although the electric utility's basic job in industry is to supply electric power, it performs another important function in the field of industrial modernization. During the past 20 or 30 years, many industries have made substantial progress in improving their efficiency through electrification. But in many more the process has scarcely begun, if at all. This offers opportunities for further industrial progress.

If these opportunities are to be fully exploited, there must be close cooperation between industry, the manufacturers of electrical equipment, and the utilities in the development of new electrical tools and techniques.

While the electric utility's role in community development involves responsibilities in a number of other

fields, including the very important field of residential development, our primary responsibility lies in the field of industrial progress. It is here that we can make our greatest contribution. We can do this by encouraging and assisting industry to develop new electrical tools and techniques, and by expanding our own facilities at a pace which will assure an adequate supply of electric power to implement these new methods.

Engineers Must Work To Solve Social Problems

GWILYM A. PRICE, president, Westinghouse Electric Corp, at annual dinner of the American Society of Mechanical Engineers, New York City

In this century, we have found remedies for evils that have cursed mankind for thousands of years, but we have generated new evils that demand new solutions. There are aspects of American life today that must rouse any order-loving engineer to anger and make any citizen of our land blush with shame.

Unhappily, many of our most dangerous problems are not physical and will not be solved by better research, higher productivity, or any of the other industrial virtues. I refer to the social illnesses that afflict our age.

With all possible deference, I suggest that the engineer himself—the man who knows most about the physical facts of our world—should . . . undertake a greater share in meeting the crisis we face. I ask that you help to bring sound and efficient management to government at all levels; that you analyze and attack crime, illiteracy, poverty and slums as you would analyze any major problem in your field; that you act as a catalyst for producing action among many groups in order to remedy conditions that are unworthy of civilized men in the middle of the 20th century.

It is not enough that you and your fellows have given us the stunning scientific triumphs that have blessed this land in so many ways. You must decide whether you will not help us to use that science for even better ends. Somehow the nature of man must be made to grow spiritually and intellectually. Somehow our hearts and minds, our morality and our social institutions, must be made to catch up to the technology you have created for us.

Suprene
Type RR for aerial or underground circuits and secondary network systems. Type RR rubber insulated, Neoprene sheathed cable for aerial use, duct installation, or direct burial.
Cables for 600 volts insulated with heat resisting, low water absorption compound Type RH-RW, or to customers specification.
Cables for 3,000 to 5,000 volts insulated with ozone resistant, oil base compounds, or to customers specification.
Shielding is recommended for Type RR cables 3,000 volts or higher, but such cables may be supplied with or without shielding or to customers specification.
Collyer
Send for samples and recommendations—or give details on your own special requirements. Collyer Insulated Wire Company, 245 Roosevelt Ave., Pawtucket, R. I.

Evans President of Kansas G&E

Former vice president and general manager replaces M. F. Gill, who continues as chairman of the board

GORDON W. EVANS

Gordon W. Evans, vice president and general manager of Kansas Gas & Electric Co, has been elected president to succeed Murray F. Gill, who will continue as chairman of the board of directors of the company.

The newly elected official joined Kansas Gas & Electric in May, 1947, as assistant to the president. He was made vice president in August of that same year and vice president and general manager of the utility two years later.

Former Head of Missouri Utilities . . . Before going to Kansas G&E, Evans was president of Missouri Edison Co and the East Missouri Power Co. Prior to his affiliation with the Missouri companies, he served in executive posts for Public Service Co of Oklahoma and Oklahoma Power & Water Co.

Gill's career with Kansas G&E started in 1937. After serving as vice president, he was named president and general manager in 1940, becoming chairman of the board in 1949.

ASME Elects Sillcox President

Society's new head is honorary vice chairman of the board of New York Air Brake. Group appoints five regional VP's

LEWIS K. SILLCOX

Lewis K. Sillcox, honorary vice chairman of the board of the New York Air Brake Co, has been elected president of the American Society of Mechanical Engineers for 1954. The new president succeeds Frederick S. Blackall, Jr, president and treasurer of Taft-Peirce Manufacturing Co, Woonsocket, Rhode Island.

Five Regional VP's . . . ASME also elected the following regional vice presidents: Willis F. Thompson, vice president, Westcott & Mapes, New Haven, Conn.; Professor William G. McLean, head of the Department of Mechanics, Lafayette College, Thompson Chandler, Carbide & Carbon Chemical Corp, South Charleston, W. Va., Vernon A. Peterson, district manager for the Elliott Co at Los Angeles; and Professor Clifford H. Shumaker, director of the Institute of Management, Southern Methodist University.

When Sillcox joined New York Air Brake in 1927, he was named first vice president of the company. In 1948 he was made a director and the following year was elected executive vice president. Last year he was elected vice chairman of the board and became honorary vice chairman of the board this year. Sillcox, who has been identified with the transportation industry since 1903, was associated with the Chicago, Milwaukee & St. Paul Railroad prior to joining New York Air Brake.

Mulligan Made a VP by Consumer Power

Election of Claude A. Mulligan to the post of vice president has been announced by Consumers Power Co.

CLAUDE A. MULLIGAN

He formerly served as assistant to the president of the Michigan utility.

Following engineering studies at McGill University, Montreal, Can., Mulligan joined Consumers Power in 1926. Most of Mulligan's service with the company has been in the Battle Creek Division. He served there as assistant to the division manager for 16 years and division manager for three years prior to April, 1952, when he was made assistant to the president.

Saves time...money
All steel from one source

When you combine all your steel requirements on a single order to Ryerson you cut costs in many ways. One call—one order—save purchasing time and you also simplify bookkeeping—reduce clerical expense.

In addition, combining most carbon steel purchases under the Ryerson quantity differential plan brings further savings. And with larger quantities you often effect substantial reduction in freight on long hauls.

All these economies are possible when you call Ryerson for steel because Ryerson stocks are the world's largest and most diversified. Carbon steel, alloys, stainless—no matter what analyses you need, no matter what shapes and sizes, you can be practically certain of getting them all with just one call to Ryerson.

You can be sure of prompt delivery, too. So next time you need steel, no matter how many kinds or sizes, call your nearest Ryerson plant.

PRINCIPAL PRODUCTS

CARBON STEEL BARS — Hot rolled & cold finished
STRUCTURALS — Channels, angles, beams, etc.
PLATES—Many types including Inland 4-Way Safety Plate
SHEETS—Hot & cold rolled, many types & coatings
TUBING—Seamless & welded, mechanical & boiler tubes
ALLOYS—Hot rolled, cold finished, heat treated
STAINLESS—Allegheny bars, plates, sheets, tubes, etc.
REINFORCING—Bars & Accessories, spirals, wire mesh
BABBITT—Five types, also Ryertex plastic bearings
MACHINERY & TOOLS—For metal fabrication

RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • CINCINNATI • CLEVELAND • DETROIT
PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

HANDY ANDY SAYS,

DUXSEAL®
plugs 'em quick and tight

DUXSEAL is a non-hardening adhesive plastic compound made with an asbestos base. It is the ideal general utility sealing and caulking compound for duct openings, potheads, bushings, terminal boxes, and for filling multi-wire contact boxes indoors. Use it like putty, just as it comes from the handy package, for smooth, workmanlike jobs.

Duxseal stays plastic—will not slump, melt or run under ordinary temperatures. Clings to duct walls and cables but flexes with expansion and contraction. It is unaffected by water and gases, does not react with rubber, metals or painted surfaces. For full information write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ontario.

JM

Johns-Manville
SEALING COMPOUNDS

DALE E. WASHBURN

Boston Edison VP

Vice Pres Washburn's duties call for supervision over sales and rates. Jones elevated

Following the retirement of Vice Pres John A. Hurley after 40 years' service with Boston Edison Co, Pres Thomas G. Dignan announced a number of organizational changes for the company.

Dale E. Washburn was elected vice president and commercial manager. In his new assignment, he will have supervision over all sales and rate activities. Since joining Boston Edison in 1923, Washburn has served in the rate research, and purchasing and supply departments.

Assistant to President . . . In other appointments, S. Murray Jones, formerly director of rate administration and research, was named assistant to the president.

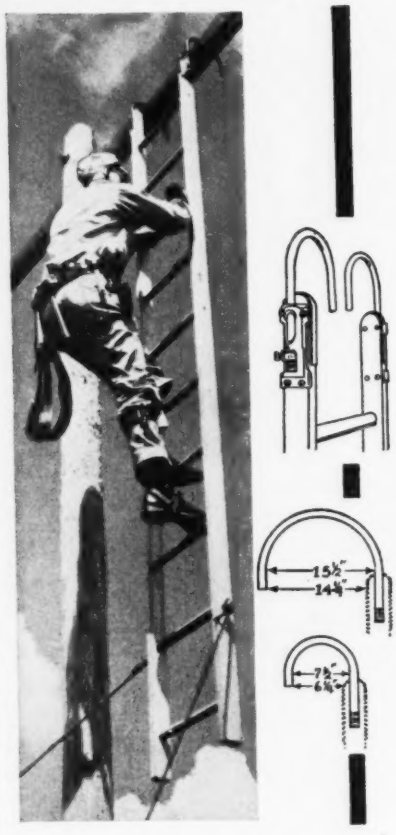
Albert J. McNulty was appointed comptroller and will continue to supervise the general accounting department. Ralph M. Kelmon was designated assistant to the treasurer and will retain his duties as superintendent of the financial estimating and planning department.

Thomas J. Galligan, Jr, was named director of Boston Edison's stores and service department.

•

Edward G. Holtzman has been elected assistant secretary and assistant treasurer of Wagner Electric Corp, St. Louis, to succeed **L. W. McBride,** who has resigned. Holtzman's former post of labor relations manager has been filled by **Truman L. King,** who has

DIECK
HOOK LADDERS



For Construction and Maintenance

- Two interchangeable hook sizes
- Hooks fold in when not in use
- 1¼" dia. hardwood rungs
- Can be supplied with standard or new heavy duty lightweight wood rails.
- Optional. Manila safety rope bracing available.

Write for complete Data. Standard rail ladders only shown in current catalog. Distributed Nationally by Line Material Company.

DIECK TOOLS

BODENDIECK TOOL CO.
TAYLORVILLE, ILLINOIS

been engaged in personnel work since joining Wagner Electric in 1937. King is succeeded as personnel relations manager by **R. A. Weiskopf,** a Wagner employee since 1946. In other appointments, **Harold S. Garrett** was made assistant director of purchases and production planning, and **Harold K. Kramer** was named purchasing agent.

Georgia Power Reveals Sales Dept. Changes

Georgia Power Co has reported the following organizational changes in its Sales Department:

E. F. Pearce was appointed assistant to the vice president in charge of sales.

B. R. Askew was made manager of the Industrial Power Sales Division and R. W. Wages, industrial power sales engineer.

Joe B. Browder is the new manager of the Commercial Sales Engineering Division, which will handle development of lighting. T. S. Davis assumes the managership of the Area Development Division.

J. H. McGuire was named sales research engineer.

Named to Executive Posts

Wheeler Reflector Co, Boston, Mass., has elected John H. Lamothe as vice president and general manager to succeed H. Alden Barnes, who has resigned from these posts to assume the duties of assistant to the president. The company has also appointed Charles D. Weston vice president in charge of sales and Fulton A. Eldridge vice president in charge of production.

•

Roger M. Purdy has been named manager of White River Electric Association, Inc, Meeker, Colo., succeeding **Kenneth Jordan.** Purdy, in the electrical distribution business since 1927, has been employed by co-operatives in Minnesota and South Dakota since 1939.

John R. Staller has been made chief engineer for switchgear and bus structures by the Roller-Smith Corp, Bethlehem, Pa. Staller, an electrical engineer, recently has been in charge

5000 WD
the New
YORK-HOOVER
TWO-MAN
LINE BODY

model 5000 WD is a sound investment for YOU...

because it will do your line work *at less cost—quicker* and *safer.*

With complete equipment it will dig the hole and set the pole, normally in a matter of minutes, all within full view and control of the truck operator.

Backed by 61 years' experience and embodying skillful engineering and honest workmanship, the model 5000 WD body with equipment represents a truly outstanding investment.

Before you purchase any line equipment, make sure you have thoroughly looked into this modern, up-to-the-minute unit by York-Hoover.

GET THE FACTS! Write for Bulletin No. 931 today.

York-Hoover Corporation
YORK, PENNSYLVANIA
Body Division

Check with Superior on

TEST SWITCHES

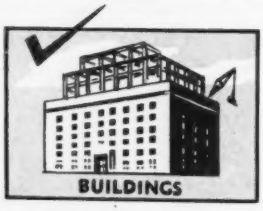
Full range of sizes and types for the best in modern metering practice.

For full information, and data on distinctive features that help you avoid trouble and cut costs, write to:

SUPERIOR
SWITCHBOARD & DEVICES CO.
CANTON, OHIO
A subsidiary of
The Union Metal Manufacturing Company

CHECK

FLINT STEEL



ONE Call for Every Steel Need

If you need structural steel, galvanized steel, reinforcing bars and mesh and pans or special fabrication — ONE Call to Flint will secure it all! Delivery can usually be made from our compete stocks. Flint also provides Planning and Scheduling services.

- STRUCTURAL
- PLATE
- WAREHOUSE
- REINFORCING
- GALVANIZED

FLINT STEEL CORPORATION
P. O. BOX 1289 TULSA, OKLAHOMA

of the engineering phases of equipment being manufactured by Roller-Smith for contractors on atomic energy installations throughout the country.

Clayton S. Coggeshall, assistant to the general manager of General Electric Co's Turbine Division at Schenectady, N. Y., has retired after 42 years' service with GE. Coggeshall served as manager of sales for the Turbine Division from 1938 until 1951.

Leo A. Grant, senior assistant engineer in the transmission and distribution department of Toledo Edison Co, has been promoted to senior power engineer and transferred to the power sales department. Grant's former duties have been assumed by **Archie L. King,** senior assistant engineer in system operations.

Loren Woolf, Sacramento Division sales supervisor for Pacific Gas & Electric Co, has been promoted to commercial manager of the Shasta Division at Red Bluff, Calif.

OBITUARY

Paul S. Clapp

Paul S. Clapp, 63, retired utilities executive and electrical engineer, died Dec. 5 at New York.

After serving as special assistant to Herbert Hoover, who was then Secretary of Commerce, Clapp became in 1926 managing director of the National Electric Light Association, now known as Edison Electric Institute. He was vice president of Columbia Gas & Electric Corp from 1932 to 1942, and then became vice president of both Ohio Fuel Gas Co and Cincinnati Gas & Electric Co. In 1945 he was made vice president of the Columbia Engineering Co.

John O. Binney, 53, an electrical engineer with Southern California Edison Co, died Nov. 13 at Los Angeles. At the time of his death, Binney was senior communication engineer for the company's Alhambra, Calif., communications department. He had been with the utility 20 years.

Merle R. Griffeth, 76, retired publicity director for General Electric Co in the New England area, died at Georgetown, Mass., Nov. 21.

Have you a fly ash recovery problem?

Bring it to
WESTERN PRECIPITATION

. . . The Only Organization With Years Of "Know-How" In BOTH *Electrical* And *Mechanical* Recovery Methods!

If you have any kind of a suspension-recovery problem—whether dust, fly ash, fume, fog or mists—it will pay you to bring it to the leading organization in the field . . . WESTERN PRECIPITATION CORPORATION. Western Precipitation not only pioneered, over 44 years ago, the first commercial application of the now-famous COTTRELL Electrical Precipitators, but also has been a leader for many years in the *mechanical* recovery field with its widely-accepted MULTICLONE Collectors.

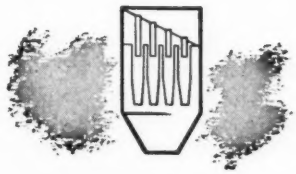
Result:

Western Precipitation is unsurpassed in the all-important factor of "know-how" in BOTH the electrical and mechanical fields . . . knows from years of first-hand experience whether your particular problem can best be solved by mechanical or electrical methods—*or by a combination of the two* . . . can give you a direct and unbiased recommendation on the matter . . . and then can provide the complete installation under *one* responsibility, *one* overall performance guarantee, even where Combination Multiclone-Precipitator (CMP) installations are made!

Western Precipitation products and services include . . .

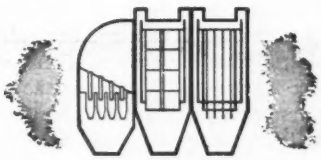
COTTRELL
Electrical Precipitators

. . . the most efficient recovery equipment for high recovery, long life, low maintenance on practically any type of suspensions, wet or dry. COTTRELLS can be designed to handle a few c.f.m. —or millions—with equal ease, and at virtually any operating temperature. Recovery efficiencies closely approach 100% recovery, if desired, with very low draft loss, minimum power costs and negligible labor costs. *By all standards, Western Precipitation* COTTRELLS *give highest recovery at lowest cost per-year-of-service!*



MULTICLONE
Mechanical Collectors

. . . the most efficient, most compact, most trouble-free mechanical equipment for recovering suspensions from gases. Because of their unique small-tube design, MULTICLONES are unsurpassed in mechanical recovery efficiencies—require less space, less maintenance, and are far simpler to install. No filters or screens to replace, nothing to burn or cause fire hazards, no high speed moving parts to repair or replace. These and many other advantages make MULTICLONE Collectors the logical choice on installations where mechanical recovery is selected.

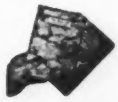


CMP UNITS
(Combination Multiclone-Precipitator)

. . . combine, in *one* compact installation, *both* mechanical and electrical recovery principles so that maximum benefit is obtained from the advantages inherent in each method. The MULTICLONE section centrifugally removes the larger and heavier suspensions (down to a few microns in diameter) . . . and the COTTRELL section then electrically removes the very small particles remaining in the gases. Thus, the bulk of the recovery is obtained with relatively low-cost equipment, and the final clean-up is obtained with equipment having unusually high recovery efficiency—approaching theoretically perfect, if desired.

The recovery of suspensions from gases is a highly exact science and every problem is different. Some require mechanical methods—others electrical methods—still others a combination of mechanical and electrical methods in proper balance to meet the individual requirements of each application. No matter what your problem, remember that only Western Precipitation has had years of field experience in BOTH mechanical and electrical methods!

Send for descriptive literature!



Let our experienced engineers study your recovery requirements and make an unbiased recommendation on the equipment best suited to your particular problem. A wire, phone call or letter to our nearest office places this unique "know-how" at your service, without obligation.

WESTERN Precipitation CORPORATION

DESIGNERS AND MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1004 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA
CHRYSLER BLDG., NEW YORK 17 • 1 N. La SALLE ST. BLDG., CHICAGO 2
1429 PEACHTREE ST. N.E., ATLANTA 5 • HOBART BLDG., SAN FRANCISCO 4
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

MULTICLONE—T.M. Reg.

Copper Prices . . .

. . . may fluctuate as Chilean output is put on world competitive market

The copper market may experience moderate price fluctuations now that Chile has given the go-ahead signal to American-owned copper mines in the South American country to start selling current copper production at world competitive prices.

The American mines are Anaconda Copper Mining Co's Chuquicamata and Potrerillos mines, and Kennecott Copper Corp's Braden mine. These mines furnish about 90% of Chile's capacity.

Price Test . . . With the return of Chile's monthly production of 30,000 tons to the market after a lapse of five months, copper's price stability of 30¢ will be tested. The extra supply from Chile is expected to result in a lower price for copper. This lower price is expected to occur in the custom smelter field and will be put to the first test when custom firms and the big world producers begin to market metal for January delivery. Custom smelters have been selling at 29½¢ a lb and the big producers at 30¢ a lb.

Some Chilean copper is expected to be available immediately for delivery this month to American industry. It will come from Chilean copper that is in the United States—approximately 80,000 tons. However, starting with January delivery, monthly output of Chilean mines will be marketed regularly in competition with other foreign copper producers.

Chile's return to competitive marketing of its regular copper production came after a favorable vote of the Chilean Senate on government proposals to correct Chile's copper problems. The Senate approved selling present stocks at 30¢ a lb. This action is contrary to copper trade assumptions that Chilean copper sales would be determined by conclusion of U. S. negotiations for purchase of 100,000 tons of Chile's unsold copper stocks.

Negotiations, which were suspended a few weeks ago, are expected to be resumed shortly.

Sangamo to Offer New Watthour Meter

Sangamo Electric Co, Springfield, Ill., expects to make available in mid-January sample units of its new J2 15-amp meter for testing by the utility industry. The company also plans to start quantity shipments of certain types of the J2 meter by the end of March with all single-phase meters by mid-1954 slated to be of the J2 basic types.

Mechanism of the low-speed, high torque general service meter is being explained by Sangamo's Vice Pres James Patton (left) to H. B. Berning (middle), meter engineer, Central Illinois Public Service Co, and T. Oakley (right), general system meter supervisor, Illinois Power Co. The meter has a continuous current rating of 100 amps, and its accuracy from 1 amp to 100 amp does not deviate more than 0.3 of a per cent plus or minus from 100% registration. It is a slow speed meter making ⅔ of a revolution per min per amp.

Cable Delivery to BPA Is Started by Alcoa

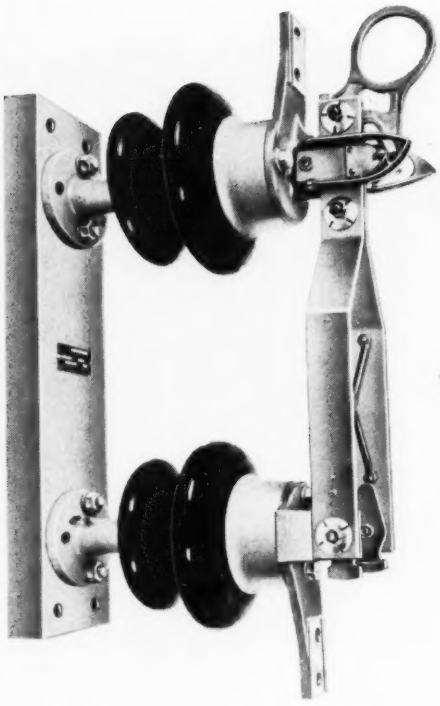
Aluminum Company of America has started delivering to Bonneville Power Administration the steel reinforced cable for the 345,000-v line, the largest single power line order in the industry's history.

Two rail cars, carrying reels holding 4,600 ft and weighing nearly 10,000 lb each, have already moved out of the Vancouver, Wash., plant en route to Whitcomb, Wash., near McNary Dam, where BPA will use the cable on that end of the new line to link the Columbia River powerhouse with the Portland-Vancouver area. Other portions later will be used for the Chief Joseph Dam-Snohomish substation links supplying the Puget Sound area.

MANUFACTURERS' EARNINGS

Company	Period Months Ended		Net Income 1953	Net Income 1952	Earnings Per Common Share 1953	Earnings Per Common Share 1952
Anaconda Wire & Cable	9	Sept.	$4,992,825	$4,715,659	$5.92	$5.59
Corning Glass Works	40 wks	Oct.	10,198,314	7,092,972	3.76	2.58
Nash-Kelvinator	12	Sept.	14,123,026	12,603,701	3.25	2.90
Reliance Elect. & Engineering	12	Oct.	1,832,778	1,816,140	4.01	3.97(a)

Notes—(a) Based on shares now outstanding.



If you were a substation operator

. . . you, too, would want the sturdiness and operational ease of **Memco** switches

To the operator, the most important consideration of hook operated switches is the ability to make speedy, positive openings and closings in all kinds of weather.

When stick switches are operated from an angle, due to narrow aisles or obstructions, the side pull on ordinary switches tends to distort the blade and prevents easy operation. Memco stick switches are constructed with high strength cross braces between wide truss blades in all voltages to prevent distortion and assure faultless operation every time.

Large pulling eyes facilitate insertion of the switch hook at a distance or from directly beneath. Blade latches act to lock the blades securely against short circuits, yet an easy pull activates the pry out or seal break feature and opens the switch.

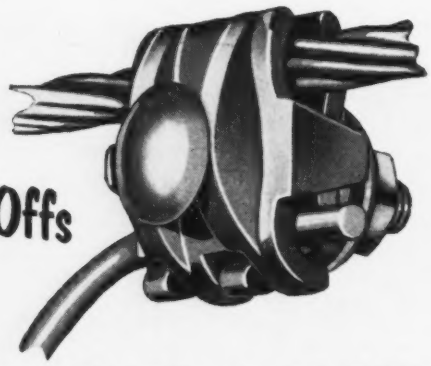
Every detail of these switches is designed for sturdiness and ease of operation and they are constructed so that operators can depend on them for unfailing performance every time.

For more details about these trouble-free switches write for Bulletin #532 just out.

"Specify MEMCO Switchgear"

MEMCO ENGINEERING & MANUFACTURING CO., INC. • Commack, L.I., N.Y.

Make Small Jobs of Large Cable Tap-Offs with KEARNEY PARALLEL GROOVE CLAMPS



The two, high-strength clamping members are secured with one, two or three heavy steel bolts, depending on clamp size. These bolts are readily tightened with a single wrench, distributing force evenly over a wide area for permanent, high-pressure contact without wire damage.

Parallel Groove Clamps are cast of bronze and heavily plated for any Conductor Combination of Aluminum or Copper.

Specify KEARNEY PRODUCTS

JAMES R. KEARNEY CORPORATION, ST. LOUIS, MO., GUELPH, ONT.

JAMES R. KEARNEY CORPORATION • 4224-42 Clayton Ave., St. Louis 10, Mo.

231

For Better Construction - For Safer Maintenance

SPECIFY Grip-Tite EXPANDING ANCHORS

GRIP-TITE MANUFACTURING CO.

WINTERSET, IOWA

"Pioneers in the Anchor Field"

TERMINAL BLOCKS

Any number of poles, front or back connected, with or without cover—Sliding Link Type.

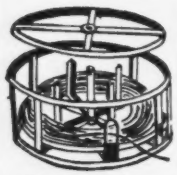
RESISTORS - OHMSPUN

Non-inductive, flexible, or rigid. Widely used as heater units, dummy antennas, etc.

THE STATES COMPANY

3 New Park Ave. Hartford, Conn.

THE WHITAKER



An all metal, non-wobble, self-attended WIRE REEL, with automatic brake operated by outgoing wire, accurately adjustable safety pay-out, and take-up.

Sent on 10-Day Free Trial Offer

Write for information and prices

WHITAKER REEL MANUFACTURING CO.

P. O. Box 1138 Monroe, Louisiana

The cable is part of Alcoa's $3,985,000 contract which calls for delivery of 1,327 miles of the cable by late 1954, according to Alcoa's Vancouver fabricating manager E. D. Mairs. It involves nearly 17 million lb of aluminum.

Westinghouse Is Bullish on Its Appliance Sales

An increase in its appliance business of 10 to 15% above 1953 is the expectation of Westinghouse Electric Corp for 1954, according to John H. Ashbaugh, vice president of the corporation's Appliance Division. This increase is expected despite general feeling that next year will be one of adjustment to a somewhat lower level of business activity.

As of now, Westinghouse faces no problem of appliance inventory. But, it is concerned with adequacy of appliance production capacity. This condition is expected to be mitigated, if not cured, by the now beginning production of refrigerators at the new Columbus, Ohio, plant.

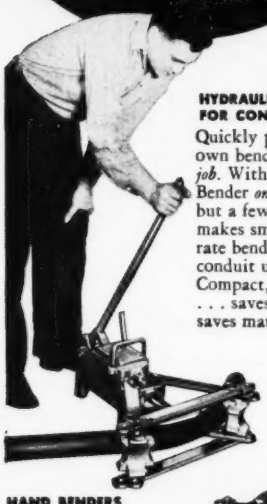
No change in appliance distribution methods is contemplated by Westinghouse, said Ashbaugh, since shipment of mixed car loads to dealers has been in effect for some time and is now about 35% above this time last year.

MANUFACTURING BRIEFS

To further expand its metallurgical program, Westinghouse Electric Corp plans to build a new metals development plant at Blairsville, Pa. Scheduled for completion by late 1955, the one-story, 480-ft long plant will gear its production to feeding specialty materials within Westinghouse. L. B. McCully, vice president in charge of the firm's East Pittsburgh Divisions, said. Many Westinghouse-developed alloys now play a key role in the production of electric generators, transformers, and jet engines.

Detroit Edison Co recently played host to electrical engineers from Sargent & Lundy, Pioneer Service & Engineering Co and Eric Floor at their new St. Clair Station for the purpose of examining Cope standard cable trough.

CUT COSTS WITH GREENLEE TIMESAVING TOOLS FOR ELECTRICIANS



HYDRAULIC BENDERS FOR CONDUIT, PIPE

Quickly produce your own bends *right on the job*. With a GREENLEE Bender *one man* in but a few minutes makes smooth, accurate bends in pipe and conduit up to 5". Compact, portable . . . saves hours, saves materials.

HAND BENDERS FOR TUBING, PIPE, CONDUIT

Quickly form small-radius bends without flattening or kinking. Especially designed to make neat bends for sharp corners, nooks and other close quarters. Saves up to 75% in time and materials on many jobs.

KNOCKOUT PUNCHES AND CUTTERS

For fast, easy enlarging of knockouts and cutting of holes in metal boxes, cabinets, panels. Various sizes and models for making openings for conduit sizes from ½" up to 3½". To operate, simply turn with a wrench.

HYDRAULIC KNOCKOUT PUNCH DRIVER

Portable hydraulic unit for driving GREENLEE Knockout Punches. Speeds jobs . . . easily operated. Develops over 11 tons of pressure so that conduit openings are cut in 10-gauge metal with ease.

CABLE PULLER AND BORING TOOLS

Specifically designed to save time, speed jobs . . . eliminate tedious, heavy work. Companion tools to many other GREENLEE timesavers for the electrician.

GREENLEE

Write for new Electrical Tool Folder, Greenlee Tool Co., 1812 Columbia Ave., Rockford, Ill.

SALES ASSIGNMENTS

COMPANY STAFFS

Allis-Chalmers Manufacturing Co, Milwaukee, Wis., has assigned William T. Havron as a sales representative to the Miami branch office of its General Machinery Division.

Highway Trailer Co, Edgerton, Wis., has named E. L. Townley as Western regional manager with headquarters in St. Paul, Minn. The company also appointed Raymond O. Hahn as manager of its Cincinnati branch. For the past three years Townley has been with the General Truck & Equipment Co, St. Paul, in the capacity of sales manager for Highway trailer sales and associated equipment. Hahn has served Highway Trailer for the past three years as a salesman in the branch he now manages.

General Electric's Co's Omaha (Neb.) Apparatus Sales Office has announced the appointment of Richard B. Scott as manager of the Lincoln (Neb.) office. Scott, an electrical engineer, formerly served the Omaha Office staff as sales engineer.

MEETINGS CALENDAR

Edison Electric Institute
EEI-AGA Accounting Employer Relations, Hotel Cleveland, Cleveland, Ohio, Dec. 14; Commercial Electric Space Heating and Air Conditioning Committee, Canton, Ohio, Dec. 17-18; Industrial Relations Committee, EEI Headquarters, New York, Dec. 17; Accident Prevention Committee, Hotel Statler, Boston, Jan. 18-19; Industrial Relations Committee, Joint Meeting with Personnel Administration Section, Southeastern Electric Exchange and Southwestern Personnel Group, Hotel Roosevelt, New Orleans, La., Jan. 21-22; EEI-AGA Taxation Accounting Committee, Arlington Hotel, Hot Springs, Ark., Jan. 27-29; Transmission and Distribution Committee, Hotel Cleveland, Cleveland, Ohio, Feb. 9-10; Electrical Equipment Committee, Sheraton Cadillac Hotel, Detroit, Mich., Feb. 15-16; Industrial Relations Committee, EEI Headquarters, New York, March 18; Sales Meeting, Edgewater Beach Hotel, Chicago, April 5-8; EEI-AGA Accounting Conference, Hotel Statler, Boston, April 12-14; Industrial Relations Committee, Netherlands Plaza Hotel, Cincinnati, Ohio, April 15; Annual Meeting, Atlantic City, N. J., June 1-4.

National Rural Electric Cooperative Association
Annual Convention, Dinner Key Auditorium, Miami, Fla., Jan. 11-14.

Doble Client Conference
Sponsored by Doble Engineering Co., Sheraton Plaza Hotel, Boston, Jan. 11-15.

American Institute of Electrical Engineers
Winter General Meeting, Statler Hotel, New York, Jan. 18-22; Conference on Feedback Control, Claridge Hotel, Atlantic City, N. J., April 22-23; Northeastern District Meeting, Schenectady, N. Y., May 5-7; Summer General and Pacific General Meeting, Hotel Biltmore, Los Angeles, June 21-25; Conference on Telemetering, Morrison Hotel, Chicago, May 24-26.

***Canadian Electrical Association**
Eastern Zone Meeting, Chateau Frontenac, Quebec, Que., Jan. 18-22, 1954; Western Zone Meeting, Royal Alexandria, Winnipeg, Man., March 1-3; Annual Convention, Murray Bay, Quebec, Que., June 24-26.

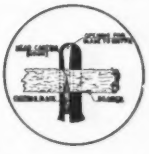
***Instrument Society of America**
9th Annual Regional Conference, Hotel Statler, New York, Feb. 4.

WORK GOES FASTER, EASIER with SEYMOUR SMITH tools

The choice of tree men for generations

No. 11 Pruner Head

Center Cut Action



"TELEPHONE" TREE PRUNERS

The very finest of tree pruners! Virtually unbreakable heads, selected spruce poles with positive locking, seamless aluminum joints. Simple, powerful action. No. 11-18, 1" capacity, $16.00. No. 12-18, complete pruner 1½" capacity, with 18 foot pole, $24.75. Extension sections available.

POLE PRUNING SAW

No. 20 SAW HEAD
Head only $4.20
with 18 ft. pole $16.00

16" needle-tooth saw blade fits in 3 different positions. Extra large hook for pulling out loose branches. Paint brush holder.

LOPPING SHEARS

6 models to choose from. Cut up to 2" branches with ease.

NEW, FINEST EVER PRUNING SAWS

A new Seymour Smith development — the fastest, easiest cutters on the market. Complete line of 6 models covering all requirements up to chain saw work.

FREE: Send for full descriptive matter and prices on all Seymour Smith products for professional pruning and tree care.

SEYMOUR SMITH
OUR 104th YEAR
The Line of Quality

SEYMOUR SMITH & SON, INC., 32412 Main St., Oakville, Conn.

GUARANTEED!

Accurate Weight

...Accurate Length

as Marked

When it's a Haartz-Mason made tape *you know* it's full length . . . full weight. *You know* it's full strength in substance. *You know* its adhesive stays *fresh longer. You know* there's no better tape made than Paramount, Stronghold and Paraplastic . . . because they're Guaranteed.

Haartz-Mason, Inc.

WATERTOWN 72, MASS.

It Pays to Know these brands

All guaranteed accurate length — accurate weight as marked.

Industrial Electrification Council
National Industrial Electric Heating Conference, Netherlands Plaza Hotel, Cincinnati, Ohio, Jan. 18-22.

***Western Computer Conference-Exhibit**
Sponsored jointly by American Institute of Electrical Engineers, Institute of Radio Engineers, and Association for Computing Machines Computer Conference Committee, Ambassador Hotel, Los Angeles, Feb. 11-12.

Missouri Valley Electric Association
Industrial and Commercial Sales Conference, President Hotel, Kansas City, Mo., Feb. 4-5; Engineering Conference, President Hotel, Kansas City, Mo., April 7-9.

Electrical Equipment Representatives Association
Winter Annual Meeting, Biltmore Hotel, Los Angeles, Feb. 8-11.

***National Association of Purchasing Agents**
Mid-Winter Conference, Public Utility Buyers' Group, Lord Baltimore Hotel, Baltimore, Md., Feb. 15-16.

Pennsylvania Electric Association
Winter Meeting, Transmission-Distribution Committee, Lord Baltimore Hotel, Baltimore, Feb. 11-12.

Public Utilities Advertising Association
Region 5 Meeting, Atlanta, Ga., Feb. 11-12; Region 1 Meeting, Montreal, Mount Royal Hotel, Que., Feb. 25-26; National Convention, Hotel Statler, Boston, May 13-14.

Southern Safety Conference-Exposition
Kentucky Hotel, Louisville, Ky., March 7-9.

National Electrical Manufacturers Association
Spring Meeting, Edgewater Beach Hotel, Chicago, March 8-11.

National Association of Corrosion Engineers
Tenth Annual Conference and Exhibition, Kansas City, Mo., March 15-19.

Southeastern Electric Exchange
21st Annual Meeting, Boca Raton Hotel, Boca Raton, Fla., March 22-24.

American Power Conference
Sherman Hotel, Chicago, March 24-26.

Oklahoma Utilities Association
Annual Convention, Biltmore Hotel, Oklahoma City, March 25-26.

***Northwest Public Power Association**
Annual Convention, Winthrop Hotel, Tacoma, Wash., March 31-April 1-2.

***Pacific Coast Electrical Association**
Administration Services Section, Hotel Claremont, Berkeley, Calif., April 7-8; Annual Convention, Hotel Del Coronado, Coronado, Calif., May 19-21.

***Illuminating Engineering Society**
Inter-Mountain Regional Conference, Denver, Colo., April 15-16; South Pacific Coast Regional Meeting, Museum of Art, San Francisco, April 19-20; Canadian Regional Meeting, King Edward Hotel, Toronto, Ont., April 28-30; Great Lakes Regional Meeting, Sheraton Cadillac Hotel, Detroit, May 3-4; Midwestern Regional Meeting, Hotel Jefferson, St. Louis, June 17-19.

American Welding Society
National Spring Technical Meeting, Hotel Statler, Buffalo, N. Y., May 4-7.

CIGRE
International Conferences on Large Electric High-Tension Systems, Paris, France, May 12-22.

National Association of Electrical Distributors
Annual Convention, Atlantic City, N. J., June 6-11.

American Society of Mechanical Engineers
Semi-Annual Meeting, William Penn Hotel, Pittsburgh, June 20-24.

Michigan Electrical Association
Annual Convention, Grand Hotel, Mackinac Island, Mich., June 27-30.

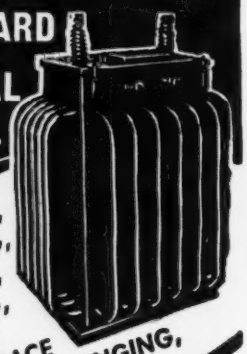
*Addition this week.

EISLER

TRANSFORMERS

STANDARD • SPECIAL

AIR • OIL • WATER-COOLED



POWER, LIGHTING, HEATING, WELDING, ELECTRIC FURNACE PHASE CHANGING, ETC.

EISLER Transformers are built strictly to N. E. M. A., A. S. A. and A. I. E. E. standards.

SEND FOR NEW CATALOG NO. TR-50

½ TO 500 KVA • UP TO 15,000 V.

CHAS. EISLER

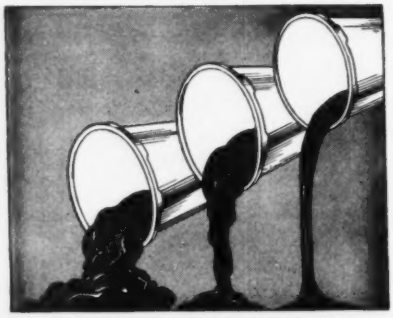
EISLER ENGINEERING CO., Inc.

789 SOUTH 13TH ST. NEWARK 3, N. J. U. S. A.

Insulating and Cable-Pulling

COMPOUNDS

of Record-Breaking Performance



Minerallac gives you a complete assortment for every need: dense, viscous and fluid consistencies for high and low voltages in cable-joints, pot-heads, terminal bills, distribution cables, street lighting, telephone work. . . . Insoluble in oil or water, for all temperatures. Clean, safe, economical—outranks all others in quality.

Send for new literature and prices.

MINERALLAC ELECTRIC COMPANY

25 North Peoria Street—Chicago 7, Illinois

MINERALLAC

Iowa-Illinois

(*Continued from page* 144)

not less than $25 million for the Illinois District electric properties. Accordingly, we feel that the schedule of increased electric rates should be allowed as modified by this order."

Proxy Soliciting . . .

. . . by a Puget Sound P&L stockholders group is described as unnecessary and uncalled for

While a committee of Puget Sound Power & Light Co stockholders solicited proxies allowing it to inspect the company's stock and transfer books, Pres Frank McLaughlin, in a letter to Puget stockholders, described the committee as "absolutely unnecessary and uncalled for."

Stockholders who sign the proxies are asked to make the Boston law firm of Burns, Blake & Rich their attorney and agent. A committee of which Francis Currie of New York is counsel and secretary contends it represents holders of around 600,000 shares, about one fourth of the company's 2,177,879 shares of voting stock. It presumably hopes to obtain proxies from holders of at least half the company's stock, for presentation at the company's annual meeting in March.

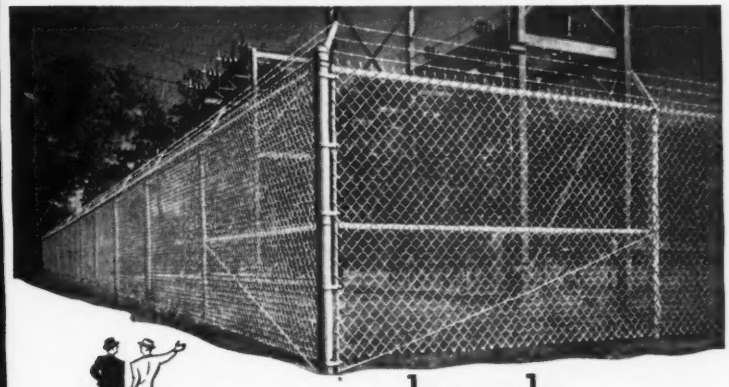
Puget Directors Mere Puppets . . . The committee "has seemingly had as its objective the forcing of Puget's management to follow a course of action with respect to a merger with the Washington Water Power Co, McLaughlin declared in his letter. "The whole idea appears to be to deny Puget's directors their rightful prerogatives as trustees for all company stockholders, and to have them perform as mere puppets when the committee pulls the strings."

McLaughlin, in his letter, reported that the company's general counsel and secretary had met on Nov. 18 with Currie, following Currie's protesting action of the board of directors in refusing to extend agreements to merge with Washington Water Power Co or sell to a group of PUD's.

"Inasmuch as Currie did not advance any basic factors additional to those of which the directors were cognizant when they reached their conclusion on Nov. 12, the board re-

PAGE FENCE - Since 1883

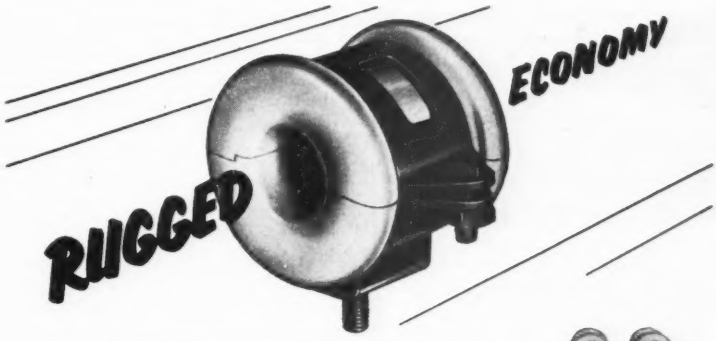
• AMERICA'S FIRST WIRE FENCE •



When you think of hazards think of PAGE, the pioneer name in fence protection for persons and property. Security is a job for Page Chain Link Fence, available in heavily galvanized Copper-Bearing Steel, long-lasting Stainless Steel or corrosion-resisting Aluminum. But this pioneer name means more than a quality product. It is a complete fence service, performed by more than 100 firms having technical training and fence erection know-how, and conveniently located throughout the country. For Page Fence data and name of firm nearest you—

Write to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Los Angeles, Philadelphia, New York or San Francisco.

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.



WIDE RANGE OF SIZES AND TYPES.

Available in units of one, two, three or four conductors for flat or pipe mounting. Sizes range from conductor diameters of 5/16" to 3 1/2".

3E supports are substantially built from the finest materials. We can make prompt deliveries from our large stock.

3E

Write for Bulletin 201

ELECTRICAL ENGINEERS EQUIPMENT CO.

Melrose Park, Illinois

CLAMP INSULATOR SUPPORTS

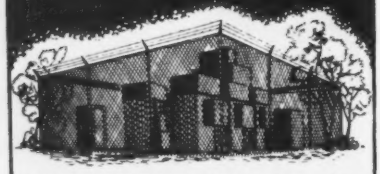
High Visibility
CAUTION SIGN
ALL METAL
NON-TILTING
DURABLE

For street and highway use. 19" wide by 30" high. Sign plate 18" x 18" yellow background with black letters . . . same reading both sides. Folds compactly for storing.

Write for Bulletin No. 25

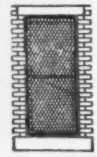
IPCO *Safety Equipment for all Industries*
INDUSTRIAL PRODUCTS COMPANY
2808 N. Fourth St., Philadelphia 33, Pa.

THESE STEWART PRODUCTS PROTECT UTILITIES PROPERTY

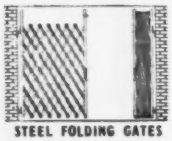


CHAIN LINK WIRE FENCE—All Beam Framework—the heaviest and strongest made

WIRE MESH PARTITIONS



WINDOW GUARDS



STEEL FOLDING GATES

- Iron Picket Fence
- Skylight Guards
- Machinery Guards
- Sliding Gates
- Railings

Don't take chances. You can't afford to be satisfied with anything less than complete protection. Write for Stewart catalogues now. Please mention products in which you are especially interested.

THE STEWART IRON WORKS CO., INC.
2166 Stewart Block, Cincinnati 1, Ohio
Experts in Metal Fabrications Since 1886

Stewart IRON and WIRE FENCES

affirmed its decision not to extend either the merger or purchase agreement," McLaughlin declared.

"This committee is accusing Puget's directors of acting arbitrarily in their decision not to submit the merger agreement to the stockholders for a vote. In view of the experience with respect to the PUD purchase, and numerous good and sufficient reasons 'legal and otherwise'—it is Puget's position that before a stockholders meeting would be called to act on a merger there would have to exist assurance that promptly after the stockholder makes his choice, he would receive either cash or stock. On no other basis is the stockholder protected and his interests safequarded," McLaughlin declared.

Public Favors Puget in Business . . . He expanded on a point he had previously made that public sentiment now favors Puget's staying in business. He listed opponents of the merger and included, with the letter, a 28-page booklet reprinting a number of newspaper editorials speaking kindly of Puget.

Puget already having refused to extend the Nov. 20 expiration date of a proposed purchase agreement, five Washington State PUDs have dropped all immediate joint purchase plans, said Harvey Benson of Anacortes, chairman of the executive committee representing the PUDs.

As far as the PUD's are concerned, condemnation within the various counties where Puget Power operates is the only alternative. McLaughlin feels this alternative to be unlikely, although one PUD, Thurston County, is understood to be considering pressing its condemnation action against the company's distribution system in that county.

The PUD's have condemnation suits pending against most of the Puget's generating properties but have done nothing to activate them.

FINANCIAL BRIEFS

Construction Expenditures—Philadelphia Electric Co will spend $310 million for the five years through 1958 of which $76 million will be spent in 1954 . . . Public Service Co of Colorado is planning to spend almost $57 million during the next four years on plants and equipment.

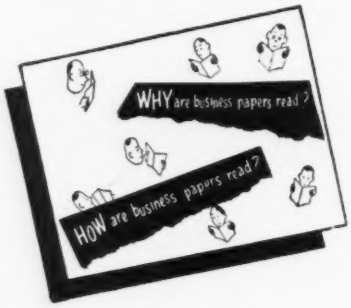
POWERCRAFT BUS SUPPORTS

• Available for prompt shipment from St. Louis, these bus supports conform to NEMA standards and have been used by many utilities and contractors. For indoor or outdoor service and for pipe or flat mounting.

Other POWERCRAFT Products
• Disconnecting Switches • Hook-Stick Operated • Indoor and Outdoor Types • Bus Clamps • Power Connectors • Pipe Frame Fittings for 1¼" I. P. S. Pipe.

New catalog just off the press. Write for your copy. A few territories available to qualified manufacturers' agents.

POWERCRAFT CORPORATION
2215 DeKalb St., St. Louis 4, Mo.
Phone PRospect 4532
Since 1932



A copy of this quick-reading, 8-page booklet is yours for the asking. It contains many facts on the benefits derived from your business paper and tips on how to read more profitably. Write for the "WHY and HOW booklet."

• • • • • • • • • • • • •

McGraw-Hill Publishing Company, Room 2710, 330 West 42nd St., New York 36, N. Y.

In hand hoists—

It's Coffing

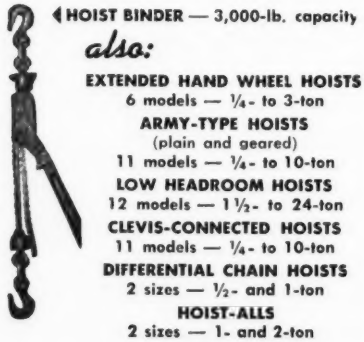
OVER 80 SIZES AND MODELS TO FILL ALL YOUR NEEDS

SAFETY-PULL RATCHET LEVER HOISTS
10 roller-chain models — 1,500- to 30,000-lb.

2 coil-chain models—1,500- and 3,000-lb.

CHALLENGER LIGHTWEIGHT ALL-STEEL SPUR-GEAR HOISTS
3 models — ½-, 1-, and 2-ton

MIGHTY-MIDGET PULLERS
2 sizes—500- and 1,000-lb.



HOIST BINDER — 3,000-lb. capacity

also:

EXTENDED HAND WHEEL HOISTS
6 models — ¼- to 3-ton

ARMY-TYPE HOISTS
(plain and geared)
11 models — ¼- to 10-ton

LOW HEADROOM HOISTS
12 models — 1½- to 24-ton

CLEVIS-CONNECTED HOISTS
11 models — ¼- to 10-ton

DIFFERENTIAL CHAIN HOISTS
2 sizes — ½- and 1-ton

HOIST-ALLS
2 sizes — 1- and 2-ton

SPUR-GEAR HOISTS
22 models — ¼- to 25-ton

Ask for more information on the units you need from the most complete line of hand-operated hoists. Write Dept. E 12.

COFFING HOIST COMPANY
DANVILLE, ILLINOIS

40 Georgia Communities Share Home Town Prizes

Forty Georgia communities have been announced as winners in the $8,950, 1953 Champion Home Town Contest sponsored by the Georgia Power Co. In all, 190 communities competed. Judges based awards on the civic improvement made during the past year.

Statesboro won the special sweepstakes award of $1,000 and a bronze plaque. This competition was open only to first prize winners in the 1952 and 1953 contests. Other winners were:

- **Under 1,000 population . . .** Cleveland, first; Doraville, second; and Ila, third.
- **1,000 to 2,999 population . . .** Monticello, first; Lithonia, second; and Alma, third.
- **3,000 to 20,000 population . . .** Manchester, first; Swainsboro, second; and Blakely, third.

The prizes in each division were $1,000 and a bronze plaque for first, $750 for second, and $500 for third. In addition four towns in each group as honorable mention winners will each receive $100 and a bronze plaque. Six in each division will receive certificates of achievement. The top winners will receive their awards at a series of dinners to be held in the winning towns after the first of the year.

Penn Water Tests Flyash for Fertilizing Properties

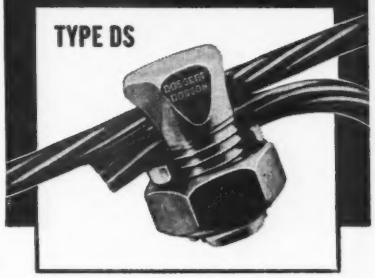
An experiment designed to test the fertilizing properties, if any, of flyash is being undertaken by Pennsylvania Water & Power Co. Reports so far have indicated that there is no appreciable difference in plant growth when flyash is mixed with the soil, but flyash has proved suitable as a soil extender.

The tests have shown that vegetables retain their flavor. Penn Water engineers consider preliminary experiments successful to date and expect to continue the experiments on a larger scale in 1954.

Disposal of flyash from the company's present 30,000-kw steam plant adjacent to its Holtwood, Pa., hydroelectric plant has never presented much of a problem. However, when its new steam generating unit, now

DOSSON SERVICE CONNECTOR

TYPE DS



Proven by actual test and years of operation under all climatic conditions to permanently connect two wires with greater security and tightness. For quick, efficient connections of solid and stranded conductors in sizes No. 14 to 1000 MCM. High contact pressure between conductors assures trouble-free performance.

1. High translation of torque by low coefficient of friction
2. High contact pressure
3. Free from vibrational loosening
4. Withstands high tightening torque
5. Maximum contact area
6. Made of high strength "DURONZE" alloy
7. Better conductivity
8. High corrosion resistance
9. Economical—can be used over and over again
10. Dossert precision-manufactured

IMMEDIATE DELIVERY!

DOSSERT REPRESENTATIVES IN THE FOLLOWING CITIES:

Atlanta, Georgia
Bay City, Michigan
Boston, Massachusetts
Carnegie, Pennsylvania
Cincinnati, Ohio
Cleveland, Ohio
Columbia, South Carolina
Dallas, Texas
El Paso, Texas
Kansas City, Missouri
Knoxville, Tennessee
Lakewood, Colorado
Little Rock, Arkansas
Minneapolis, Minnesota
New Orleans, Louisiana
Omaha, Nebraska
Philadelphia, Pennsylvania
Richmond, Virginia
St. Petersburg, Florida
St. Louis, Missouri
San Francisco, California
Seattle, Washington
Williamsville, New York

DOSSERT MFG. CORP.
249 HURON STREET, BROOKLYN 22, N. Y.
SINCE 1904

PROFESSIONAL SERVICES

Consulting Accounting Valuations — **Management Appraisals Construction** — **Designing Testing Financing** — **Inspections Cost Analysis Investigations**

BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
36 State Street, Albany, N. Y.

BLACK & VEATCH

Consulting Engineers

Electricity—Water—Sewage—Industry

Reports, Design, Supervision of Construction, Investigations, Valuation and Rates

4706 Broadway Kansas City 2, Missouri

THEODORE D. BROSS & COMPANY

Steel Tower & Wood Transmission Lines

Distribution & Maintenance

175 Enfield St. Hartford, Conn.

DAY & ZIMMERMAN, INC.

Engineers

Design - Construction - Management
Investigations and Reports

New York Philadelphia Chicago

Doble Engineering Company

Electrical Insulation Engineers

Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications

Office and Laboratory: Doble Park
Box 344, Belmont 78, Mass. (6 miles from Boston)
Branch Office: 20 N. Wacker Dr. Chicago, Ill.

Ebasco Services Incorporated

Engineers - Constructors - Business Consultants

Design and Construction
Financial and Operating Consultation
Investigations and Reports
Consulting Engineering

Two Rector Street New York
Chicago • Washington, D. C.

ELECTRICAL TESTING LABORATORIES, INC.

Electrical, mechanical, photometric, radiometric and chemical laboratories, rendering testing, research and associated services, including certification, inspections at factories and field investigations.

2 East End Avenue at 79th St., New York 21, N. Y.

ROBERT E. FOLEY CONSTRUCTION CORPORATION

Design—Surveys—Appraisals
Construction & Maintenance

Transmission—Distribution—Communication Lines
Substation, Radio and Television Towers

48 Griswold St. Binghamton, N. Y.

FORD, BACON & DAVIS

Engineers

DESIGN • CONSTRUCTION
VALUATIONS • REPORTS

New York • Chicago • Los Angeles

GILBERT ASSOCIATES, Inc.

Engineers • Consultants • Constructors
Reading, Pa.

Engineering and Design • Construction Supervision
Industrial • Sanitary • Safety
Chemical Laboratory Services
Business and Economic Research
Industrial Relations • Purchasing

New York Philadelphia Washington
Rome Manila Medellin

HARZA ENGINEERING CO.

Consulting Engineers

L. F. HARZA
E. MONTFORD FUCIK CALVIN V. DAVIS

Hydroelectric Plants and Dams
Transmission Lines
Flood Control, Irrigation
River Basin Development

400 West Madison Street Chicago 6

HOOSIER ENGINEERING COMPANY

Erecting Engineers
Transmission Lines, Substations

1384 Holly Avenue, Columbus, Ohio

JACKSON & MORELAND

Engineers and Consultants

Utilities and Industrials
Design and Supervision of Construction
Reports—Examinations—Appraisals
Machine Design—Technical Publications

Boston New York

THE KULJIAN CORPORATION

Engineers - Constructors - Consultants

Power Plant Specialists

Utility - Industrial - Chemical

1200 N. Broad St., Philadelphia 21, Pa.

LARAMORE and DOUGLASS, INC.

Consulting Engineers

Power Plants
Transmission Distribution
Design — Reports — Appraisals — Rates

79 East Adams Street
Chicago 3, Illinois

Peter F. Loftus Corporation

Engineering and Architectural Consultants and Designers

First National Bank Bldg.,
Pittsburgh 22, Pennsylvania
Cable Address—"LOFTUS Pittsburgh"

N. A. LOUGEE & COMPANY

Engineers and Consultants

REPORTS — APPRAISALS
DEPRECIATION STUDIES — RATE CASES
BUSINESS AND ECONOMIC STUDIES

120 Broadway New York

LUCAS & LUICK

Engineers

DESIGN, CONSTRUCTION, SUPERVISION, OPERATION, MANAGEMENT, APPRAISALS, INVESTIGATIONS, REPORTS, RATES

231 S. LaSalle St., Chicago

LUTZ & MAY

Consulting Engineers

STEAM, GAS & DIESEL POWER STATIONS
PUMPING PLANTS—ELECTRIC SYSTEMS
REPORTS—DESIGN—APPRAISALS

1009 Baltimore Kansas City 6, Mo.

CHAS. T. MAIN, INC.

Engineers

Electric, Steam and Hydraulic Projects, Investigations, Reports, Designs and Appraisals

Chamber of Commerce Building
80 Federal St., Boston 10, Mass.

Middle West Service Company

Consultants

Utility and industrial accounting, financing, evaluations, consulting engineering, reports, appraisals, rate studies, labor relations, public and employee relations, safety, insurance, pension plans, sales promotion.

20 N. Wacker Drive Chicago 6

MINER and MINER

Consulting Engineers
Incorporated

Greeley Colorado

ARTHUR L. MULLERGREN

Engineering - Management
Public Utilities—Natural Gas

Kansas City, Mo.

PIONEER SERVICE & ENGINEERING CO.

Consulting and Design
Engineers . . Purchasing . .
Specialists in Financing
Accounting and Other Operations

231 So. La Salle St. Chicago 4

under construction, goes into operation next year the company will be faced with the disposal of some 70,000 tons annually.

The Holtwood properties are on the Susquehanna River, surrounded by the rich Lancaster County agricultural areas. Penn Water engineers, pondering the flyash problem, decided to try it as fertilizer. Four garden beds were prepared, each 8 ft wide by 45 ft long. Bed No. 1 contained 100% flyash, 6 in. deep; Bed No. 2 contained 20% flyash, or one inch worked into 4 in. loose top soil; No. 3 contained a heavy dressing of ash; and No. 4 was virgin soil.

Into these beds were planted various garden crops such as beans, radishes, onions, cabbages, corn, peas, etc.; farm crops such as tobacco, oats and soy beans; ground covers such as periwinkel and rye grass; flowers of various types and young trees. People who have eaten products, such as radishes, onions, peas, and string beans, reported they detected no difference in taste qualities between vegetables grown in 100% flyash and those in untouched soil.

Cowlitz PUD Opposes Load Limitation Plan

A Bonneville Power Administration proposal that would impose a 5,000 kw limitation on new industrial loads of Cowlitz County, Wash., PUD is being resisted. The public agency plans to argue its opposition in Washington, D. C., this month. And there have been hints at consultations with neighboring Clark PUD where similar long-term contract revision is reported underway at BPA suggestion.

The PUD's are the two largest of southwest Washington where industrial growth has boomed, spurred by expansion of lumber fabrication and expansion of aluminum plants at Vancouver and Longview. Surveys have indicated continued growth prospects and the two public agencies are concerned that the new BPA limitation, coupled with a 10,000-kw limitation involved in recently signed long-term BPA contracts with utilities of the region, will tie their hands further.

Cowlitz Board Chairman Earl J. Cole declared that the proposal was "a definite threat to the efforts of this community to obtain new industries."

PROFESSIONAL SERVICES

Recording & Statistical Corp.
BILL ANALYSIS—CONSUMPTION STUDIES
THE ONE-STEP METHOD
Bill Frequency Analyzer
100 Sixth Ave. WOrth 6-2700 New York 13, N. Y.

REIS & CHANDLER, INC.
ADVISORS TO UTILITIES
Financing—Rate of Return
30 Vesey Street, New York 7, N. Y.

SANDERSON & PORTER
Engineers and Constructors
New York • Chicago • San Francisco

SARGENT & LUNDY
ENGINEERS
140 South Dearborn St.
Chicago, Ill.

F. W. SCHEIDENHELM
Consulting Engineer
Hydraulic Engineering, Hydro-electric Development, Water Supply, Flood Control. Engineering Problems relating to Water Rights and Water Power Law. Appraisals.
50 Church Street, New York 7, N. Y.

F. A. TUCKER, INC.
Contractors—Engineers
specialize in
Distribution - Transmission - Telephone lines - Maintenance - Roads - Bridges Dams
Main Office—88½ Center Street, Rutland, Vt.
Branch Office—120 East 3rd St., Charlotte, N.

UTILITIES LINE CONSTRUCTION COMPANY, INC.
Construction and Maintenance
Transmission - Distribution
Electric and Telephone Lines
Consultants
501 York Road, Jenkintown, Pa.

THE J. G. WHITE ENGINEERING CORPORATION
Design • Construction • Reports • Appraisals
80 Broad Street, New York 4

SEARCHLIGHT SECTION
(Classified Advertising)
EMPLOYMENT • BUSINESS EQUIPMENT — USED OR RESALE OPPORTUNITIES

UNDISPLAYED RATE
$1.20 a line, minimum 3 lines.
To figure advance payment count 5 average words as a line.

Employment Wanted and Individual Selling Opportunity Wanted undisplayed advertising rate is one-half of above rate, payable in advance.
Box Numbers—Care of publication count as one line.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.
Equipment Wanted or For Sale Advertisements acceptable only in Displayed Style.

DISPLAYED RATE
Individual Spaces with border rules for prominent display of advertisements.
The advertising rate is $11.25 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
An advertising inch is measured ⅞" vertically on one column, 3 columns — 30 inches—to a page.

ELECTRICAL ENGINEERS
SENIORS—Experienced public utility electrical design, transmission and distribution engineers required by an established consulting organization for work on continued program of plant expansion, transmission and distribution planning and betterment work for public utility operating companies located in eleven Latin American countries. Headquarters New York; possibly some travel. Preferred age range 30-45. Attractive salaries. Excellent opportunities for qualified men. Reply stating age, education, experience and personal particulars.
P-1018E, Electrical World
330 W. 42 St. New York 36, N. Y.

WANTED:
ENGINEER with Electric Power Distribution Experience
We are a large, well-known electrical manufacturer entering the field of capacitor control. We need an engineer 25 to 35 years old with experience in the application and control of static capacitors on electric power distribution systems. Position involves considerable travel to our district offices and working with our sales engineers. Please submit outline of qualifications.
P9962 Electrical World,
330 W. 42 St., New York 36, N. Y.

TRANSFORMER ENGINEER
Familiar with all phases of design and construction of dry type and oil filled transformers through 10,000 KVA. Give complete background and experience. Excellent future, growing concern. Location New Jersey-Greater N. Y. area.
P-9852, Electrical World
330 W. 42 St., New York 36, N. Y.

ADDITIONAL SEARCHLIGHT ADVERTISING
on Pages 234 and 235

Advertising In This Issue

Aerotec Corp., The 209
Air Preheater Corp., The 103
Allen-Bradley Co. 35, 36
Allis-Chalmers Mfg. Co. ..... 3rd Cover
20, 21, 32, 33, 66, 67, 94, 158, 159
Aluminum Co. of America 54
American Telephone & Telegraph Co. 89
Anaconda Wire & Cable Co. 101

Bakelite Co., Div. Union Carbide & Carbon Corp. 61
Baldwin-Lima-Hamilton Corp. 46
Bechtel Corp. 19
Bodendieck Tool Co. 218
Bristol Co., The 64
Brown Company 206
Brown Boveri Corp. 24, 25, 105
Bussmann Mfg. Co. 182, 183

Cable Spinning Equipment Co. 208
Chase-Shawmut Co., The 197
Chevrolet Div., General Motors 102
Coal Chemical Sales Div. United States Steel Corp. 108
Coffing Hoist Co. 229
Collyer Insulated Wire Company 215
Copperweld Steel Co. 8
Cornell-Dubilier Electric Corp. 59
Crescent Tool Co. 73
Crouse-Hinds Co. 18

De Laval Separator Co., The 58
Delta-Star Electric Div., H. K. Porter Co., Inc. 157
Directory of Engineers 230, 231
Dossert Mfg. Corp. 229
Dow Chemical Co., The 203
Driver-Harris Co. 72

Eisler Engineering Co., Inc. 226
Electric Controller & Mfg. Co. 44
Electric Machinery Mfg. Co. 82, 83
Electric Service Mfg. Co. 48, 49
Electric Storage Battery Co. 106
Electrical Engineers Equipment Co. 227
Elliott Co. 62, 63
Engineers, Directory of 230, 231
Erico Products, Inc. 99
Ethyl Corp. 212
Everstick Anchor Co. 164

Fidelity Machine Co., Inc. 50
Fisher-Pierce Co., Inc., The 176
Flint Steel Corp. 220
Foster Wheeler Corp. 86, 87
Four Wheel Drive Auto Co., The 93

Gai-Tronics Corp. 210
General Cable Corp. 69
General Electric Co.
Apparatus Dept. 11, 38, 39, 145 146, 147, 148, 151, 153, 154, 155
Construction Materials Dept. 88
Gould-National Batteries, Inc. 76
Graybar Electric Co. 5
Greenlee Tool Co. 225
Grinnell Co., Inc. 7

Grip-Tite Mfg. Co. 224
Gulf Oil Corp. 13
Guth Co., The Edwin F. 207

Haartz-Mason, Inc. 226
Hazard Insulated Wire Works 4
Holophane Co., Inc. 41
Hotpoint Co. 47
Hubbard & Co. 199

Ideal Industries, Inc. 29
Indiana Steel & Wire Co. 184
Industrial Products Co. 228
Ingersoll-Rand 22, 23
I-T-E Circuit Breaker Co. 70, 71
I-T-E Circuit Breaker Co., R&IE Equipment Div. 97

Jenkins Brothers 12
Johns-Manville 218, 236

KPF Electric Co. 31
Kearney Corp., James R. 172, 173, 224
Keasbey & Mattison Co. 98
Koppers Co., Inc. 169, 204
Kuhlman Electric Co. 74, 75

Lapp Insulator Co., Inc. 78, 79
Leeds & Northrup Co. 161
Luther Engine Div. Luther Corp. 181

Memco Engrg. & Mfg. Co. 223
Minerallac Electric Co. 226
Minneapolis-Honeywell Regulator Co., Industrial Div. 90, 91
Moloney Electric Co. 109, 110, 111 112
Murray Mfg. Corp. ..... 2nd Cover

National Electric Coil Co. 52
National Telephone Supply Co. 104
Nordberg Mfg. Co. 96

O. Z. Electrical Mfg. Co., Inc. 84
Ohio Brass Co. 165, 166, 167, 168
Okonite Co., The 4
Orangeburg Mfg. Co., Inc. 95

Pacific Electric Mfg. Corp. 9
Page Fence Ass'n 227
Penn-Union Electric Corp. 177
Pennsylvania Transformer Co. 162, 163
Permutit Co., The 51
Pfaff & Kendall 53
Phelps Dodge Copper Products Corp. 14, 15
Philco Corp., Industrial Div. 37
Porcelain Products, Inc. 100
Powercraft Corp. 228
Preformed Line Products Co. 42, 43
Protectoseal Co., The 65

Radio Corp. of America Engineering Products Dept. 6
Reliable Electric Co. 205
Remington Rand, Inc. 92

Reynolds Metals Co. 174, 175
Ripley Co., Inc. 55
Rockbestos Products Corp. 233
Royal Electric Mfg. Co. 45
Ryerson & Son, Inc., Joseph T. 217

Sangamo Electric Co. 16
Schield Bantam Co. 34
Schwager-Wood Corp. 77
Searchlight Section 231, 234, 235
Shell Oil Co. 17
Silent Hoist & Crane Co. 202
Simplex Wire & Cable Co. 10
Smith & Son, Inc., Seymour 225
Square D Co. 107
Standard Oil Co., (Indiana) ..... 4th Cover
Standard Transformer Co. 178, 179
States Co., The 224
Stewart Iron Works Co., Inc., The 228
Subox, Inc. 211
Superior Switchboard & Devices Co. 220

Thomas & Betts Co., The 40
Thomas & Sons Co., R. 200, 201
Triangle Conduit & Cable Co., Inc. 56, 57
Tulsa Winch Div., Vickers, Inc. 214

Union Carbide & Carbon Corp. Bakelite Div. 61
United States Rubber Co. 28
Uptegraff Mfg. Co., R. E. 60

Victor Insulators, Inc. 171

Wagner Electric Corp. 26, 27
Western Precipitation Corp. 221
Westinghouse Electric Corp. 80
81, 185, 186, 187, 188, 189, 190, 191 192, 193, 194, 195, 196
Westinghouse Electric Corp. Sturtevant Div. 68
Weston Electrical Instrument Corp. 30
Wheeler Reflector Co. 85
Whitaker Reel Mfg. Co. 224

York-Hoover Corp. 219

■

PROFESSIONAL SERVICES 230, 231

■

SEARCHLIGHT SECTION
(Classified Advertising)
H. E. Hilty, Mgr.

EMPLOYMENT
Positions Vacant 231, 234
Selling Opportunities Offered 234
Positions Wanted 234
Selling Opportunities Wanted 234
EQUIPMENT
(Used or Surplus New)
For Sale 234, 235
WANTED
Equipment 234

230°F
IT'S THE A.V.C. CONSTRUCTION THAT MAKES THE DIFFERENCE
OUTER FELTED ASBESTOS WALL
VARNISHED CAMBRIC
INNER FELTED ASBESTOS WALL
You can get life-long dependable service under severe operating conditions because these walls of impregnated felted asbestos permanently resist heat and moisture, mechanical damage and effectively seal the high dielectric varnished cambric tapes from deterioration.

ROCKBESTOS A.V.C.® (N.E.C. TYPE AVA)

PREVENTS WIRE FAILURES... CUTS MAINTENANCE COSTS WHERE TEMPERATURES RUN HIGH

Get started on a failure-prevention campaign if you want to avoid future trouble in your power, control and lighting circuits. Look into all possible trouble-sources such as high ambient temperatures, probable overloads, exposure to moisture, oil, grease and corrosive fumes . . . then specify Rockbestos A.V.C., (AVA) the wire designed to meet these conditions.

These permanently insulated wires and cables guarantee long and trouble-free service in circuits exposed to severe operating conditions because they have an impregnated asbestos insulation that is heat and flame resistant. It won't bake brittle, crack or flow in temperatures up to 230°F . . . and won't deteriorate with age or rot when exposed to oil, grease or fumes.

Protect "hot-spot" circuits around boilers, furnaces, kilns, soaking pits, pump rooms, steam tunnels and heat-exposed ducts with Rockbestos A.V.C. (AVA). It will eliminate re-wiring jobs and expensive maintenance. 125 different standard types are available in 600 to 5000 volt ratings.

T Hi® ... *Your best buy*

ROCKBESTOS
PRODUCTS CORPORATION
NEW HAVEN 4, CONNECTICUT

NEW YORK • CLEVELAND • DETROIT • CHICAGO
PITTSBURGH • ST. LOUIS • LOS ANGELES • NEW ORLEANS
OAKLAND, CALIFORNIA • SEATTLE

PERSONNEL-INDUSTRIAL RELATIONS EMPLOYE TRAINING

Public utility companies located Latin America require men for positions of industrial relations engineers, and supervisors of employe training and personnel departments. Applicants should have at least 5 years experience in their particular specialty and general acquaintance with public utility operations. Knowledge of Spanish or Portugese desirable but not required initially. Positions offer promising fields for applicants with individual initiative, having good background of practical experience in their particular field. Salary commensurate with position, experience and living costs. Reply stating age, education, experience and personal particulars.

P-1020, Electrical World
330 W. 42 St. New York 36, N. Y.

ELECTRICAL ENGINEERS

JUNIORS—Graduate electrical engineers for station design, transmission and distribution work required by an established consulting organization for work on continued program of plant expansion, transmission and distribution planning and betterment work for public utility operating companies located in eleven Latin American countries. Headquarters New York—possibly some travel. Preferred age under 30. Experience 0-5 years. Salary commensurate with qualifications. Splendid opportunities for right men. Reply stating age, education, experience and personal particulars.

P-1019, Electrical World
330 W. 42 St. New York 36, N. Y.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

WANTED — SALES Manager for well known Manufacturer of Power and Distribution Transformers. Salary $15,000 to $20,000. P-9256, Electrical World.

WANTED: ELECTRICAL Engineer for Office and Field Work. Central Illinois Public Service Co., Springfield, Illinois. Att. Electrical Engineer.

ELECTRICAL ENGINEER for office and field work. Recent college graduate or experienced engineer who might prefer working for a small utility in a rural area, good schools, fine residential area. Please give full details including salary expected in first letter. P-9900, Electrical World.

ELECTRICAL ENGINEER required for design of transmission and distribution lines for large public utility company located in Western Pennsylvania. Office and field work. Permanent employment with opportunity for advancement. Reply to P-1022, Electrical World.

WANTED: CHIEF Engineer for a medium sized growing eastern electric company to be in charge of transmission, distribution, construction, system planning. Must be technical graduate of proven executive ability. Age 40 to 48. Box P-1048, Electrical World.

SELLING OPPORTUNITIES OFFERED

SALES ENGINEER, age 25-35, some technical background desirable, to call on utility industry from Chicago office of long established cable company. Permanent position, salary and expenses. State age, educ., experience, refs., sal. SW-9381, Electrical World.

EXPERIENCED SALES representative wanted by well-known manufacturer of distribution and high-tension line construction hardware to travel Southeast territory. RW-9963, Electrical World.

POSITION WANTED

EXPERIENCED SWITCHBOARD Operator would like operating job in central or substation. PW-8267, Electrical World.

SELLING OPPORTUNITY WANTED

SOUTHWEST SALES Engineer desires lines to Hardware, Electrical Industrial Wholesalers. SA-9218, Electrical World.

SALES ENGINEER
Age 30-35

Some technical background required. Administrative experience an asset. To work with utility industry on product application and development in Transmission and Distribution construction. Advise fully first reply.

RW-1049, Electrical World
330 W. 42nd St., New York 36, N. Y.

ELECTRICAL ENGINEER . . .

who has specialized in the field of electronics, capable of developing the sales of a well-established manufacturer of laminated metals in this industry. Must be free to travel. State age, starting salary expected, and references. Write direct.

IMPROVED SEAMLESS WIRE CO.
775 Eddy Street Providence, R. I.

OPPORTUNITIES!

in

New and used equipment recently released from service by a number of electric and gas utility companies

POWER PLANT EQUIPMENT
CONSTRUCTION EQUIPMENT
SUBSTATION EQUIPMENT
TRANSMISSION LINE MATERIALS

Send for new list, . . . to

EBASCO SERVICES INCORPORATED
(APPARATUS EXCHANGE)
Two Rector St., New York 6, N. Y.

ELECTRICAL WIRE AND CABLE

—YOUR BEST SOURCE—

- for every industrial and power application
- odd lengths—long and short—reasonably priced
- largest stock in Midwest
- varnished cambric—leaded—neoprene

Let us quote on requirements—send your inquiries

DELIVERY
QUICK . . . from stock
We'll also buy your Surplus
Branch Offices: Houston Yukon 5547
Los Angeles—DUnkirk 7-3265

UNIVERSAL Wire and Cable Co.
2660 N. Clybourn Ave., Chicago 14, Ill.
EAstgate 7-4777 Code: UNIWIRE

WORLD'S LARGEST INVENTORY

FREE CATALOG

MOTORS-GENERATORS-TRANSFORMERS
New and Guaranteed Rebuilt
1 H.P. to 2500 H.P.

ELECTRIC EQUIPMENT CO.
P. O. BOX 51, ROCHESTER 1, N.Y.

SUBSTATION EQUIPMENT

TRANSFORMERS

QU.	KVA	MFR.	VOLTAGE
4	2500	Mol.	69000—13800
4	500	West.	69000—6900
3	400	G. E.	66000/33000—2300/4160
3	200	Pitts.	66000—2300
3	1250	A. C.	44000/11500—460
4	150	West.	44000/33000—2300/6900
3	75	West.	44000—7200/12470 Y
3	5000	G. E.	38100/66000—6600
4	4500	G. E.	3600—13300—2400
3	3333	G. E.	33000/11000—2400/7200
3	333	G. E.	33000—7200/12470 Y
3	250	Mol.	33000—13800/23900 Y
3	200	A. C.	34500—2400/7200/12470 Y
3	75	Wag.	33000—7200/12470 Y
3	1250	G. E.	26400/13200—2400
4	1500	A. C.	25400/44000 Y—6900/13800
4	450	A. C.	25410/44000 Y—13280/23000
3	1000	Mol.	22000—2300
1	1000	A. C.	22000—2200, 3 ph.
3	100	G. E.	22000—7200/12470 Y
3	50	G. E.	22000—2300
1	600	Stand.	13200—2300, 3 ph.
1	450	Penna.	13200—2400, 3 ph. ASKAREL
3	250	Pitts.	7200—220/440
3	150	Wag.	6900—2300
3	37½	G. E.	6900—230/460
4	150	G. E.	4800/2400—240/120
2	100	G. E.	4800/2400—480/240
3	333	G. E.	2400/4160 Y—240/480
3	250	G. E.	2300/4000 Y—115/230
3	200	West.	2400—240/480
3	150	West.	2400—230/115
1	100	G. E.	2300—575, 3 ph.
6	50	West.	2400—114/228 DRY TYPE

INDUCT. REGULATORS—Outdoor

1—1510 KVA West. 660 Amp. 13200 V. 3 ph.
1— 390 KVA G. E.-Step. 541 Amp. 4160 V. 3 ph.
1— 140 KVA G. E. 200 A. 4000 V. 3 ph.
3— 96 KVA G. E. 200/400 A. 2400 V. 1 ph.
3— 48 KVA West. 200 A. 2400 V. 1 ph.
8— 36 KVA West. 150/300 A. 2400 V. 1 ph.
2— 36 KVA G. E. 75/150 A. 4800 V. 1 ph.

CIRCUIT BREAKERS

4— 800 A. 132 KV West. G-222A-2500 MVA
2— 400 A. 37 KV G. E. FHKO-136-350 MVA
1—1200 A. 15 KV G. E. FKO-139-950 MVA
4— 600 A. 15 KV G. E. FHKO-139-750 MVA

BREW, WOLTMAN & Co., Inc.
52 Church Street New York 7, N. Y.

—WANTED—

Meters

Any Quantity

ATLANTIC
Electric Meter Corp.
214 E. 41 St., New York 17, N. Y.
Vanderbilt 6-1955

WANTED

We are interested in the purchase of a ROOVERS TYPE EMBOSSING PRESS which will press pole tags from zinc tape. We will consider any reasonable offer for such machine if in fair working condition.

WATER & LIGHT DEPARTMENT
Wellsvile, N. Y.

"SEARCHLIGHT" IS Opportunity Advertising

—to help you get what you want.
—to help you sell what you no longer need.

Take Advantage Of It

For Every Business Want

"Think SEARCHLIGHT FIRST"

REBUILT AND NEW

GUARANTEED MOTORS

M.G. SETS • GENERATORS

Hoists • Compressors • Transformers
Units of Every Size and Description

MOTOR GENERATOR SETS—DC

KW	Make	AC	DC
1000	Westgh. [3 unit	11000	137/275
500	Westgh.	2300	250
300	Cr-Wh	440	250
200	Ridgeway	2300	250
200	G.E.	2300	250/275
150	G.E.	440	250/275

MOTOR GENERATOR SETS (25 cycle)

100	G.E. (150 HP Sq. Cage) 3/25/440, 750	125
100	Westgh. (150 HP Sq. Cage) 3/25/440, 750	125

AC SYNCHRONOUS MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts
(*2200 volts or higher)

HP	Make	Type	P.F.	Speed
1420	*West.		.7	900
800	*G.E.		1.0	1800
710	*G.E.	ATI	1.0	720
700	*G.E.	TS975Z	1.0	1200
600	*G.E.	TS7640	1.0	900
600	*G.E.	TS	1.0	600
600	*G.E.	ATI	1.0	240
400	West.	HG	1.0	900
300	G.E.	ATI	.8	1200
300	G.E.	ATI	.8	900
300	*G.E.	ATI	1.0	720
300	Ideal	SNS	1.0	257
250	*Cr-Wh	25184	1.0	1800
220	*West.		1.0	600
190	El. Mhy.	2S	1.0	720
175	*West.	HR	1.0	360
150	*West.	HR	1.0	300
125	*G.E.	ATI	1.0	900
125	*El. Mhy.	[illegible]	1.0	900
125	*G.E.	TS	1.0	277
115	El. Mhy.	EM	1.0	240

TRANSFORMERS

KVA	Make	Phase	Pri.	Sec.
667	G.E.(H)	1	34500	480
400	G.E.(H)	1	2300	230/440
250	G.E.(H)	1	4160	240/480
[50	Westgh. [CSP	1	7200	120/240

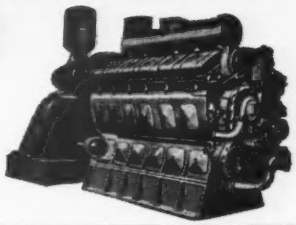
WE'LL SELL, BUY OR TRADE
PHONE CANAL 6-2900

CHICAGO Electric [illegible]

1324 W. CERMAK ROAD
CHICAGO 8, ILL.

DIESEL POWER

IMMEDIATE SHIPMENT
• PURCHASE OR RENTAL
UNIT CAPACITIES—10 TO 2475 KVA
A.C.—50 AND 60 CYCLES
• ALSO D.C. UNITS



A PARTIAL LISTING OF OUR INVENTORY

KW	Make	Model	HP	RPM	KW	Make	Model	HP	RPM
1980	Nordberg	TS-217	2800	225	320	Enterprise	DSG-6	560	450
1136	Fairbanks Morse	38D	1600	720	300	General Motors	8-268A	450	1200
1100	General Motors	16-278A	1600	720	200	General Motors	8-268A	350	900
750	General Motors	12-567	1080	720	150	Worthington	CC-4	225	450
500	Baldwin	VO-8	750	514	150	Ingersoll-Rand	8-4	225	600
500	General Motors	8-278A	750	720	150	Buckeye	40	240	600
500	General Motors	8-567	720	720	100	Worthington	BB-5	150	600
480	Worthington	DD-8	700	360	100	General Motors	3-268A	150	1200
400	Ingersoll-Rand	S-8	600	720	60	General Motors	6-71	90	1200
350	Baldwin	VO-6	510	450	30	Internat'l Harvester	UD-14	45	1200

A. G. SCHOONMAKER COMPANY, INC.
DIESEL DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

FROM AVAILABLE STOCK

TURBO GENERATORS IN STOCK

Qu.	KW	Make	Desc.
1—	1000	G.E.	Non-Cond—190 lbs-2400-3-60
1—	1000	Moore	Condensing—Extraction—190 lbs., 2400-3-60—Surface Cond.
1—	750	G.E.	Condensing—265 lbs., 440-3-60 Built 1944
1—	500	Moore	Non-Cond—150/200 lbs., 5/35 lbs. B.P., 480-3-60 Dir. Conn. Exciter.
1—	300	G.E.	Non-Cond—150/175 lbs., 5/10 lbs. B.P., 480-3-60
1—	200	Whse.	Non-Cond. 125/150# ISP 5/10# B.P., 240/480 v-3-60

FREQUENCY CHANGERS

Qu.	Kva	Make	Cycles	Voltages
1—	12500	Whse.	25/60	13200 x 13200
1—	3750	G.E.	25/60	4150/2400 x 2400/4150
1—	3125	G.E.	25/60	4150/2400 x 2400/4150
2—	2500	G.E.	25/62½	2300 x 4160
1—	1250	G.E.	25/58.3	4400 x 2300
1—	625	A.C.	25/60	11000 x 2300

MOTOR GENERATOR SETS

3 ph, 60 cy.

Qu.	KW	Make	Speed	DC Volts	AC Volts
1—	3000 3U	G.E.	514	600	4000/13200
2—	2000	G.E.	450	250	2400
2—	2000	G.E.	514	600	6600/13200
1—	2000	G.E.	500	666 25 cy.	11000
2—	1750	G.E.	514	250	2400
1—	1500	C.W.	514	115	4000/13800
1—	1500	G.E.	720	600	13200
1—	1000	G.E.	900	260	4100/6900
2—	1000	Whse.	900	600	2300/4150
1—	750	Whse.	900	275	2300/4150
1—	500	Whse.	1200	125/250	2300
1—	500	Whse.	900	250	440
1—	500	G.E.	720	125	2300

TRANSFORMERS—60 Cycle

KVA	Make	Type	Ph	Voltages
1—5000	Whse.	OISC	3	33000x26400/13200
1—3500	G.E.	WCT	3	13800 x 2300/440
1—2500	Whse.	OISC	3	26400/13200 x 480
3—2000	G.E.	HVDDJ	1	66000 x 13800
3—1250	G.E.	HVDDJ		6600/550
3—1000	G.E.	HVDDJ	1	2200/480

BELYEA

COMPANY, INC.
OFFICE & SHOP
51 Howell St. Jersey City 6, N. J.

TRANSFORMERS
FOR SALE

6—1000KVA Mol 11500-2400/4160Y
6—833 KVA G-E 35000-480
3—667 KVA W-H 35000-480
3—333KVA G-E 33000-2300/6900
3—333KVA G-E 33000-2300/4000Y
3—333KVA Mol 7200/12470Y-2400/4160Y
3—333KVA W-H 6600/2300
3—200KVA G-E 2400/4160Y-120/240
3—150KVA G-E 44000-600/2400
3—150KVA G-E 19050/33000Y-2540/4400Y
3—100KVA G-E 33000-6900/11950Y
3—50KVA A-Ch 33000-2400/4160Y
1—500KVA W-H 27600-444/131 3-ph.
1—150KVA G-E 7620/13200Y-120/208Y 3-ph.

Many other items in stock

TRANFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.
Cincinnati 27, Ohio
40 Years' Dependable Service

TURBO GENERATOR

Available Immediately
7500 KW G. E. Co.
180 P.S.I.—525°F Total Temp.
3 phase 60 cycle 2300 volt
With Surface Condenser
GOOD CONDITION

Union Electric Co. of Missouri
315 N. 12th Blvd. St. Louis 1, Mo.

$2.95 EACH OR 2 OR $5.00!

Genuine Telephone Company Upright telephone complete with cord in Tested and Guaranteed condition. For intercommunication or extension. Complete line of telephones and parts, Inter-communication systems, switch-boards, handsets, magneto and dial telephones, etc. Write for free list. C.O.D. orders accepted. All shipments F.O.B.

TELEPHONE ENGINEERING CO.
Dept. CC Simpson, Pa.

FOR SALE

3 G. E. Transformers, 200 KVA, Type H, Single Phase, Cy. 60 13200—2400/4160Y Voltage Rating

1 G. E. Oil Circuit Breaker, Volts 7500, Amp. 400, Cy. 60, Type FK-142

3 G. E. Instrument Current Transformers Model 9 JKF58, Impulse Level 95KV Amps. 75, Cy. 25-125

In excellent condition, new in 1943. If interested please contact

CHARLES T. BRANDT, INC.
1700 Ridgely Street
Baltimore 30, Md.

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT

1606 53rd ST., NORTH BERGEN, N. J. N.Y.C. Tel. LOngacre 5-3227 N. J. Tel. UNion 3-2600

TRANSFORMERS

1—1500 KVA G.E., 3 Ph., 4150V. 2300V. Pyranol
2— 750 KVA G.E., 3 Ph., 4150V. 120/240V. sec.
2— 750 KVA G.E., 1 Ph., 4600V. 115/230
2— 400 KVA Pitts., 1 Ph., 2400/4800V. 240/48V.
3— 333 KVA Whse., 1 Ph., 2400V. 600 V. sec.
2— 300 KVA G.E., 1 Ph., 13200V. 220/440V.
1— 200 KVA G.E., 3 Ph., 2400-220 sec.
3— 200 KVA G.E., 1 Ph., 13200V. 440V.

SYNCHRONOUS MOTORS

1— 300 H.P., Elec. Mach., 720 RPM, 3 Phase 60 cyc., 2200V T E F Cooled Outdoor service.
1— 150 H.P., G.E., 1800 RPM, 220V, 3/60.
2— 150 H.P., Al. Chal. 360 RPM, 440V, 3/60.

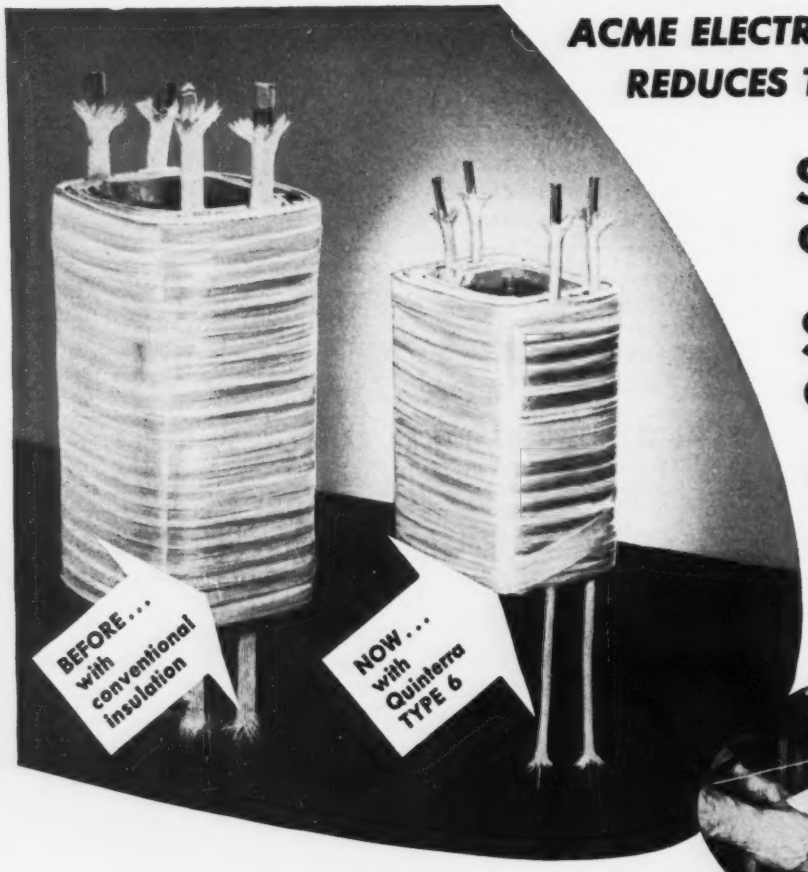
MOTOR GENERATOR SETS

1—1000 KW Whse., 600 V. 720 RPM, 4000 Syn.
1—1000 KW G.E., 600 V. 514 RPM, 4000 Syn.
1—1000 KW Whse., 275 V. 720 RPM, 4000 Syn.
1— 200 KW Whse., 250V., 900 RPM, 4000V. Syn.
1— 150 KW G.E., 125/250V. 1200 RPM, 2300 Syn.
1— 100 KW G.E., 250V. 900 RPM, 2300V. Syn.

SLIP RING MOTORS

2— 500 H.P., G.E., M 1200 RPM 2400 V.
1— 400 H.P., West., CW. 450 RPM, 550V.
1— 250 H.P., West., CW. 600 RPM, 440V.
1— 200 H.P., West., CW. 600 RPM, 440V.
3— 150 H.P., Al. Ch. 1800 RPM, 2300V., 3PH, 60 Cy.

Large Stock of A.C. and D.C. Equipment



ACME ELECTRIC CORPORATION REDUCES TRANSFORMER SIZE

Saves 40% on steel...

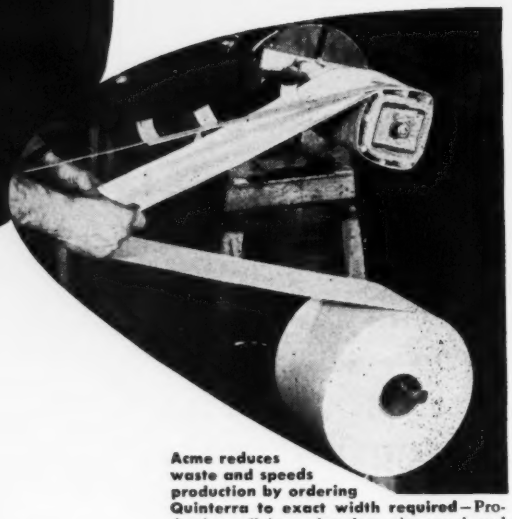
Saves 42% on copper...

Saves 44% on weight...

—by insulating coils with

Quinterra® TYPE 6

the purified asbestos electrical insulation



Acme reduces waste and speeds production by ordering Quinterra to exact width required—Production efficiency has been increased and waste has been reduced to an absolute minimum — without equipment changeover — by using Quinterra Type 6, factory-cut to Acme's dimensional specifications.

How have these tremendous savings in critical materials, weight, space, and production time affected the quality of Acme transformers?

The manager of Acme's Dry Type Transformer Division advises that not a single failure in operation of an Acme Quinterra-insulated transformer has been reported in the two years that they have been produced. Since several thousands of these units have been manufactured in this time, their quality is evident.

Here are the reasons why this Johns-Manville purified asbestos insulation has helped the Acme Electric Corporation, and many other well-known manufacturers, turn out better products and at the same time lower production costs.

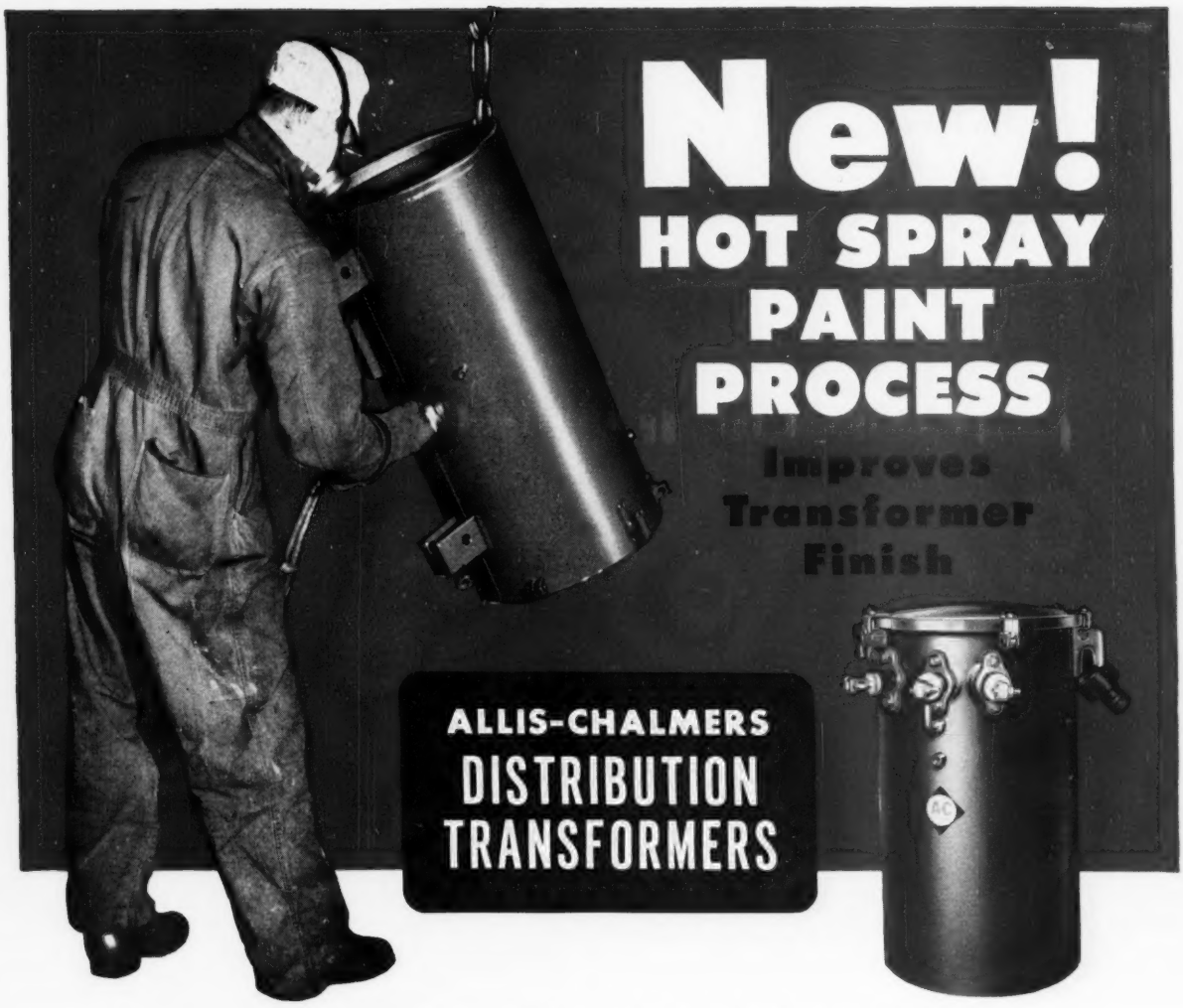
Quinterra Type 6 possesses high thermal stability and lasting dielectric strength. It is a twin-ply, polyvinyl, acetate-treated, purified asbestos insulation with a dielectric strength of 300 VPM. Even when its saturant is baked out by continuous exposure to 200 C, it retains the inherent dielectric of the base sheet which is at least 200 VPM . . . and it remains a dielectric up to 400 C.

Type 6 has high mechanical strengths because it is made by combining and calendering two layers of Quinterra together into a dense, smooth-surfaced insulation. Its good tensile and bursting strengths enable operators to achieve favorable production rates. Further economies result from its large square-foot-per-dollar coverage.

If you are a manufacturer of magnetic or resistance devices, Quinterra Type 6 . . . or one of the other Quinterras . . . may enable you to lower production costs and also to improve your product's performance. For samples and additional information, write to Johns-Manville, Box 60, New York 16, New York.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville ELECTRICAL INSULATIONS



A new Hot Spray System now used by Allis-Chalmers effectively substitutes heat for solvents in painting, to produce a higher quality finish than conventional spray processes. A smoother surface is achieved with a uniform coating that offers greater resistance to contamination and corrosive action. Pole type distribution transformers in ratings through 50 kva get this new surface treatment.

Paint Heated to 160 F

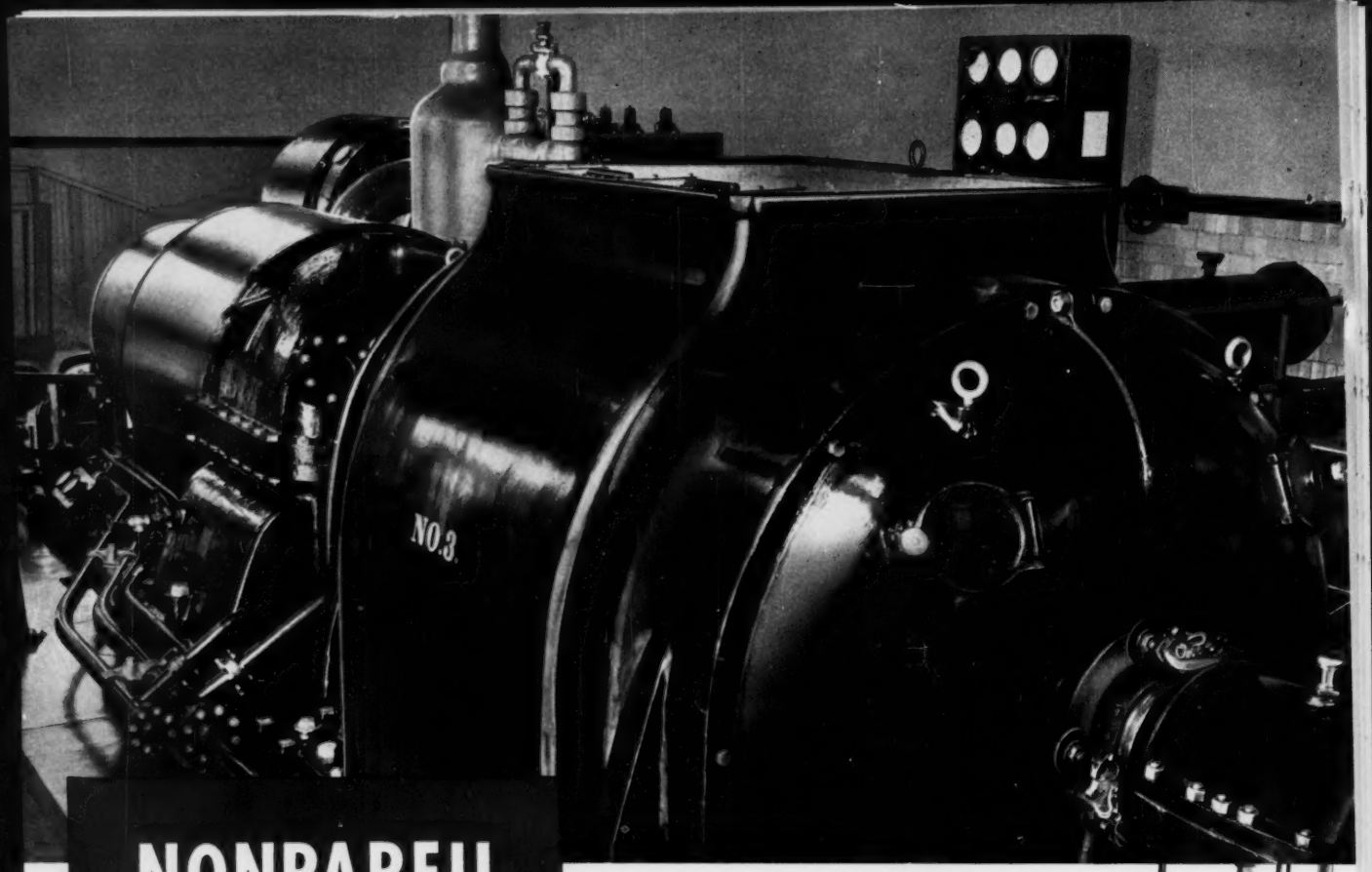
The fact that cold paint is thicker than paint kept at normal room temperature is widely recognized — cold paint takes more solvent to make it flow and atomize. In the new Allis-Chalmers hot spray process, alkyd-resinous paint is heated to 160 F. Only 15% solvent is required, compared to the 40% solvent needed in conventional spraying at normal temperatures. Since there is far less solvent to evaporate, shrinkage after the paint is applied is greatly reduced. And better filling properties, brought about by improved flow and atomization, result in a smoother surface with greater gloss and excellent coverage.

Tests Prove Value

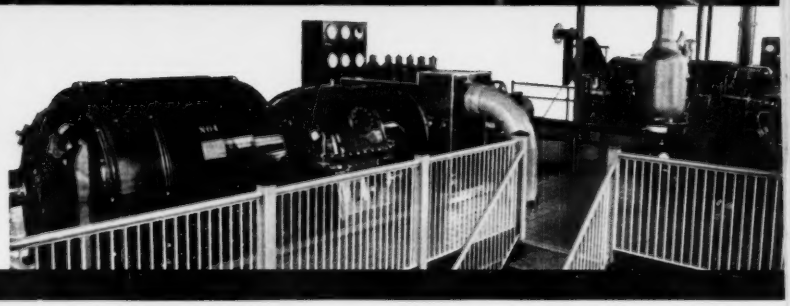
Tests conducted at Allis-Chalmers and at the Sub-Tropical Testing Laboratories at Miami, Florida show conclusively that tanks first cleansed and treated by Spra-Bonderizing and then Hot Spray painted have a superior protective surface. Test conditions included salt spray, humidity and sunlight as well as industrial atmosphere.

For more information on Allis-Chalmers new hot spray system as applied to distribution transformers, contact your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4201

ALLIS-CHALMERS



NONPAREIL
TRADE MARK
Turbine Oil



How they eliminated turbine oil replacements

● Operators of this midwest power plant recall the time when a conventional lubricant was used in the plant's three turbines (now, four). A fill of oil was good for about three years and then it had to be replaced because of increased acidity and other indications of oil deterioration.

In 1939, a Standard Oil lubrication specialist recommended NONPAREIL Turbine Oil, and the switch was made. Since that time, none of the original fills of NONPAREIL has needed to be replaced. For that matter, no fill of oil has needed to be removed from its turbine for any purpose. Lubrication systems have remained clean. Neutralization numbers of oil fills have stayed below 0.06 mg. KOH/gm. Fourteen years of trouble-free turbine lubrication is just the beginning for this plant. Each fill of NONPAREIL is guaranteed in writing to last as long as the turbine it lubricates and to maintain a neutralization number below 0.15 mg. KOH/gm.

Ask the Standard Oil lubrication specialist serving your area of the Midwest to show you how NONPAREIL and its written guarantee will assure you of completely trouble-free lubrication for the life of your turbines. Phone your local Standard Oil office. Or, write: Standard Oil Company, 910 So. Michigan Ave., Chicago 80, Ill.

STANDARD OIL COMPANY STANDARD *(Indiana)*